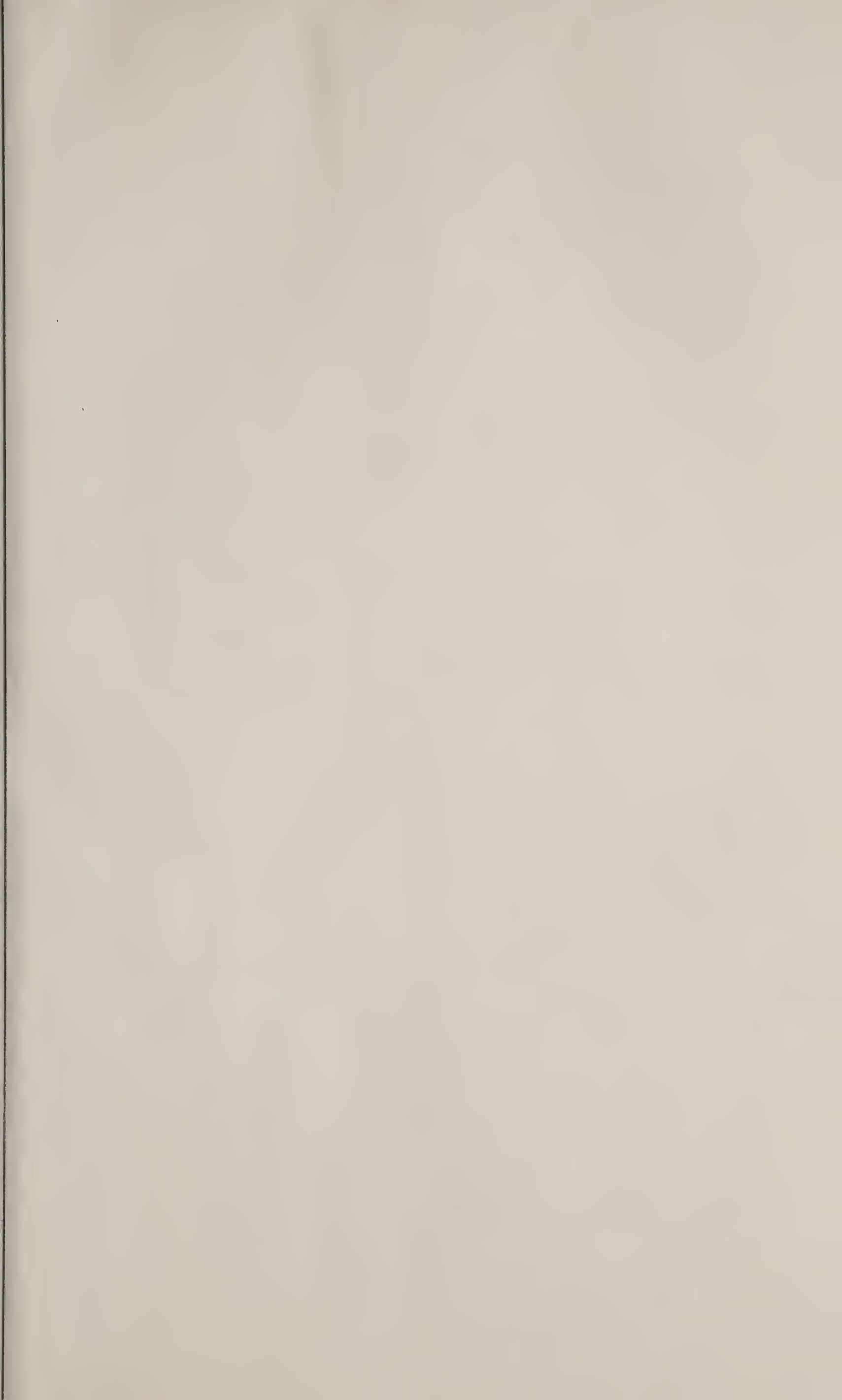


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The Green Thumb

VOL. THIRTY-FOUR, NUMBER ONE

SPRING, 1977



THE COVER
Springtime

THE GREEN THUMB

SPRING, 1977

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The Green Thumb

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Editors

— SPRING, 1977 —

Rhododendrons Will Grow in Colorado <i>Panayoti Peter Callas & Ray Radebaugh</i>	2
Happiness is — A Rock Garden <i>John G. Worman</i>	7
Versatile Viburnums <i>Jane Silverstein Ries</i>	9
Self-guided Tour in 9th Street Gardens <i>Dave Luebbers</i>	11
Bromeliads: The Undiscovered Houseplants <i>Lawrence Mason, Jr.</i>	23
Exotics of Colorado — Sycamore <i>Helen Marsh Zeiner</i>	25
Weathervanes as Garden Ornaments <i>Lorraine Marshall Burgess</i>	27
Aven Nelson Pioneer Botanist <i>Ruth Ashton Nelson</i>	29

Rhododendrons Will Grow in Colorado

Panayoti Peter Callas
Ray Radebaugh

(Continued from Winter, 1976)

Part II

Discovered before the Second World War, *Rhododendron yakusimanum* Nakai, a unique plant from the wind-swept, rain-drenched summits of a few mountains on a sub-tropical island south of Japan proper, has proven to be perfectly hardy to 20 degrees below zero Fahrenheit. In form and substance of flower, it compares favorably to the finest Asiatic species. Moreover, it is closely related genetically to the strains that produced the ironclads. The texture of the heavily felted leaves that often last seven years on the plant and the remarkably waxy and long-lasting flowers promise to add new dimensions to rhododendron hybridising. At least one hybrid "Yak", still unnamed (*R. yakusimanum* x 'Mars'), has proven ideal for Colorado. Very sun and wind tolerant, it has bloomed heavily every year for almost a decade, and the leaves have not burned even in our rigorous, chinook-ridden winters.

The main trends in cold-climate rhododendron growing, then, are the hybridization of hardy species with more tender, but superior, exotic species. There has also been much experimentation in cold climates with untested species from all over the world — many of which have proven to be equal in hardiness to our native varieties. In recent years, more attention has also been paid to America's numerous endemic rhododendrons — in particular, the dozens of azaleas concentrated in the southeast. Selective breeding is producing superior strains of most of the native rhododendron species, which retain something of their wild charm along with totally reliable winter hardiness and tolerance of summer heat. Almost every native rhododendron has something unique to offer, and most recent books and catalogs on the genus discuss them at some length. Those that are most frequently grown are *R. arborescens* Torr., *R. atlanticum* Rehder, *R. bakeri* W. P. Lemmon & McKay, *R. calendulaceum* Torr., *R. canadense* Zabel, *R. carolinianum* Rehder, *R. catawbiense* Michx., *R. vaseyi* Gray, and *R. viscosum* Torr. For local gardeners who have not yet tried growing rhododendrons, these are ideal plants to experiment with before going on to the fussier Asiatics.

Many people are frightened away from growing rhododendrons by the complex dicta about soil acidity and texture found in every discussion of the genus. Most writers seem to suggest that you should have complex and elaborate soil-testing kits and an infinite supply of virgin leaf mold — things few average gardeners have access to in Colorado. Unfortunately, soil acidity and texture are important to growing rhododendrons. In our own experience we have discovered that a porous and moisture retentive texture to the soil is more important than exact adherence to 5.5 pH soil acidity. In older parts of the front range cities, the acidity problem has almost solved itself. About sixty years ago everyone seems to have gone simultaneously up to the mountains and dug cute little spruces. The cumulative effect of several generations of spruce needles from the now giant trees has resulted in intensely acid stretches in these older neighborhoods. The prevalence of conifers and the leaching of alkalis by watering lawns and gardens has resulted in remarkably acid soils in what were originally alkaline prairies. It's still a good idea to check soil samples with a county extension agent, or ask local nurserymen about the soil in your area. Of course if you live in a new development or if your house is perched on one of the few limestone outcrops in the state, or especially if you use alkaline or hard well water, your problems will be magnified. Raised beds, new soil, additions of iron chelates and acid pine-duff are all means of circumventing your alkaline conditions. The fact that large parts of our Front Range cities have developed acid soils naturally is indicative that all is not lost, that soil-acidity need not be a constant worry and unattainable goal.

Rhododendron 'Scarlet Wonder'



Real Soil Necessary

Even though your soil may be a perfect 5.5 pH acidity like ours, it is probably still atrocious. Coloradoans use the terms "dirt" and "soil" interchangeably. Soil, real soil, is a rare commodity here, and most of us have dirt — an almost sterile, inorganic, glorified dust — in its place. To grow rhododendrons you must have a real soil that has a spongy texture and high humus content. Rhododendrons are woodland plants, but do not need pure leaf mold — you probably can't find enough anyway for even a single good sized plant, and you will have to water your plants several times daily in order to keep them from dessicating if you do. Everyone has his pet soil mix — from rotted sawdust to rich loam. If you have to start from scratch as we did, we have found the best expedient for rhododendron soil is to make it yourself from certain easily obtained sources. In making a bed for several large rhododendrons, we dig a large bed, taking into consideration how deep we want to fill in or mound up (15 or 18 inches of prepared soil is practical — some fanatics will say 3 feet), and we salvage the top 4 or 5 inches of the native soil, discarding as much of the vicious clay below as our backs can take. We fill in the hole with approximately the following proportions: one part native top soil, one part concrete sand, one part sedge peat (available from numerous dealers), and as much acid leaf mold as we can scrounge (maybe one-half part leaf mold). By using our native soil, we stiffen the mixture and keep it from being overly porous and subject to drying out. We then top-dress the whole thing with a layer an inch or two thick of pine needles (any neighbor with a big pine will usually be thrilled to get the needles off his lawn), which create a pleasant reddish contrast to the deep green of the rhododendrons. A needle mulch also discourages weeds, protects roots from heaving, freezing, and thawing, and cools the ground in the summer. Above all, it decomposes in time to help keep the soil acid. The mulch should not be disturbed, nor should any groundcover, perennials, wildflowers, or anything be allowed to grow directly under the canopy of rhododendron leaves. Rhododendrons really are shallow rooted: their roots extend only a few inches below the mulch.

No rhododendron will withstand drying. A site should be picked away from hot walls, full blast of the midday sun or windy spots. Properly situated, a rhododendron in Colorado does not need much more attention than, and about the same amount of water as a lawn — perhaps two or three good soakings a week.

High Humidity Helpful

One rhododendron and fern grower in Boulder has developed an automatic misting system using industrial nozzles with extremely fine atomizing spray that produces a real fog. This is of course not absolutely necessary, but this sort of small-scale weather modification system can produce remarkably lush results with a minimum of time and money. By raising the humidity twice a day and cooling the soil and plants, he has minimized the need for frequent irrigation, thereby saving water as well. The success after many years of his misting system has tempted others to try it — the mossy, green island of a misting bed, with lush growth of ferns and wildflowers results in a delightful contrast to otherwise sunny gardens. A mist bed can also serve as a nursery for small plants and proving grounds for untested species.

All this sounds like a lot of trouble to go to just to plant exotics not really suited to our semi-arid climate. The same, of course might be said of peonies, roses, most

vegetables for that matter, even blue-grass lawns. Few gardeners are satisfied with growing the wildflowers and grasses native to the plains and foothills. As long as there are dozens of species of rhododendrons and an infinite number of existing and possible hybrids that might grow here, and even thrive given a modicum of knowledgeable care, we think it is foolish to keep insisting that rhododendrons are meant just for the northeast or Pacific northwest. Numerous gardeners in Colorado are discovering otherwise. More than any other part of the country, the west is a land of contrasts. Few other shrubs can suggest by their rich foliage and delicate blossoms the cool mountain valleys that are the home of the genus *Rhododendron*. A thoughtful and well-grown planting of rhododendrons in a Colorado garden creates a year around counterpoint to other parts of the yard.

Below is a listing of a few of the most successful rhododendrons that have been grown for a number of years by a number of Boulder gardeners. Many more are on trial, and there are undoubtedly more we do not know of. We have not included any ironclads — which are available at several area nurseries, and from most large mail-order houses. Much of the writing about rhododendrons in the past has been directed at these, and information about them is easy to find.

Rhododendron arborescens Torr. A tall, small-flowered native azalea. It is completely hardy, but not as spectacular as most azaleas. White June flowers.

Rhododendron calendulaceum Torr. The flame azalea of the Alleghanies — it grows well here, and is the showiest native azalea. 4-5 feet, late May.

Rhododendron x 'Dora Amateis' (*R. carolinianum* Rehder x *R. ciliatum* Hook.f.) An excellent early May white flowered hybrid.

Rhododendron x Exbury Hybrids. A large complex of dozens of clones of hardy azaleas. Mostly May and early June flowering. The most frequently planted landscape azaleas in recent years. Yellow to red flowers.

Rhododendron hippophaeoides Balf. f. & W. W. Sm. Western Chinese species — 3 feet, very hardy, blue flowers in May.

Rhododendron impeditum Balf. f. & W. W. Sm., a lapponicum series rhododendron with beautiful form and tiny blue leaves. Winter hardy, but most of the buds are not set in time for winter, so that blooming is sparse. A disappointment.

Rhododendron indicaeflorum var. *macrantha*, an evergreen azalea closely related to the indoor tender species. This variety produces masses of pink blooms in late June and July. Reliably hardy and dwarf (1 to 2 feet).

Rhododendron molle G. Don. Chinese azalea, most frequently available hardy azalea in local nurseries. Reliably hardy, with heavy May bloom, yellow to orange, 4 feet high.

Rhododendron x 'Professor Amateis', (*R. everstianum* x *R. 'Van Ness Sensation'*). Large leaf of Asiatic type — flat, horizontal effect different from typical *R. catawbiense* Michx. boat-shaped leaf. Electric pink flower with maroon splotches. No indication of winter burn on leaves or buds for five past winters. Late May, 4 feet or more at maturity.

Rhododendron 'P.J.M.' Hybrid between *R. dauricum* L. of Siberia and the American *R. carolinianum* Rehder — very hardy, 4 feet at maturity. Early April bloom. Color is usually a shrill pink.

Rhododendron x 'Purple Splendour'. Semi-evergreen azalea of *R. obtusum japonicum* type, 18 inches height, mid-May, purple pink blossoms.

Rhododendron x. 'Ramapo' (*R. intricatum* Franch. x *R. carolinianum* Rehder). A fine lapponicum-type rhododendron, absolutely hardy. 18 inches, small blue-green leaf. Blue flowers in early May.

Rhododendron x 'Rosebud'. A *R. indicaeflora* var. *macrantha* type plant, 18 inches, late May, early June flowering. Double pink flowers resembling rosebuds.

Rhododendron x 'Scarlet Wonder'. A *Rhododendron repens* I. B. Balf. & Forrest hybrid much hardier than its tender parent. Still not a plant for a sunny or exposed spot, but a harbinger of future hardy, Asiatic hybrids.

Rhododendron vaseyi Gray 'Pinkshell' azalea from North Carolina. 5 feet, mid-May pink blossoms. Very hardy and attractive.

Rhododendron yakusimanum Nakai (also listed under *R. metternichii* Sieb. & Zucc. var. *yakusimanum*). 2½-4 feet depending on clone. Pink, fading to pure white flowers in early June.

Rhododendron yakusimanum x 'Mars'. An excellent hybrid, with pure pink blossoms and fine textured leaves. Sun tolerant if soil conditions are right.

From a list of many, we would recommend two nurseries to beginners: Baldsiefen Nursery, Rhododendrons for the Connoisseur, Inc., Box 88, Bellvale, New York 10912. \$2.00 catalog full of color photographs and detailed cultural notes, and Greer Gardens, 1280 Goodpasture Island Road, Eugene, Oregon 97401.

In our experience they both supply high quality stock and ship carefully.

There are numerous books and booklets available on rhododendron culture. To our minds the best booklet, available at many bookstores in the Denver area, is the Brooklyn Botanic Garden *Handbook on Rhododendrons and Azaleas*.

Exbury Azalea



Happiness is— A Rock Garden

John G. Worman

Briefly, we might define the rock garden as a form of landscaping which, apart from its decorative value, is fashioned for the successful cultivation and display of diminutive plants in a manner similar to that of their native habitat.

Today authentic rock gardens follow a definite trend in the direction of the alpine or alpine-type garden; that is, the greater part of the plant material grown consists of either true alpiners or perennial materials chosen for their close resemblance to the popular impression of what alpiners should look like. In such a garden, properly placed small evergreens might simulate timberline tree growth; there are a number of dwarf trees which are appropriate and charming. Small conifers in winter when leaves of herbaceous plants are gone unveil features which are worthy of notice.

To achieve even moderate success with a rock garden, and to provide reasonably comfortable and congenial quarters for the many types of plants usually grown, it is important to know something of the conditions under which they grow and flourish in their natural surroundings. The generally accepted authority on rock gardening is H. Lincoln Foster's *Rock Gardening — A Guide to Growing Alpines and Other Wildflowers in the American Garden*, Bonanza Books 1968.

The intent of this article is to share timely information acquired at the horticultural conference in the Northwest, summer of 1976. This was the first international conference to be held anywhere

on the cultivation, study, and conservation of American wildflowers. It attracted more than 500 individuals from the U.S., Canada, and around the world. Dr. and Mrs. Paul Maslin and Panayoti Callas of Boulder, and the John Wormans of Littleton and others attended from Colorado.

Ann Haymond Zwinger of Colorado Springs, recently awarded an honorary doctorate by Colorado College, was the featured dinner speaker — her address, "Land Above The Trees." Slides were the work of her photographer husband and depicted alpine tundra wildflowers found in the Central Rocky Mountains. Many of the spectacular photographs were taken in the Mt. Goliath Native Plant Area and at Summit Lake on Mt. Evans.

The proceedings of the twelve sessions sought to expand present plant knowledge of North America's plains and mountains, shores and deserts — of wildings well known though perhaps misunderstood, others yet to be fully appreciated. Perhaps the British Columbia Alpine Garden Club's greatest contribution to the conference was the execution of 22 alpine plantings in troughs, each representing an American mountain range or other physiographic region, on display at the University of British Columbia campus in concert with the publication, *Plant Lists of the Americas*.

The symposium, "Some Unique Edaphic Situations," suggested that the secret to cultivation of a good many alpiners considered difficult is to "bring

them up on shortcomings," to quote W. E. Th. Ingwerson. To illustrate the wisdom of this it is necessary to realize that a good many plants are not equipped by their genetic make-up to cope with the easy, soft life. Both climate and soil contribute — perhaps equally, certainly synergistically (working together) — to the derivation and dispersal of all life forms. Edaphic, in this case soil influence, is possibly the greater of the two according to the speakers as evident in some situations such as limestone barrens, pumice environ, pine barrens, prairie, shale barrens.

James MacPhail's explorations of the northwestern mountain ranges qualified him to assess "polsters." From the German, rock gardeners borrowed *polsterbilden* (meaning cushion-formed), shortened it to polster, thus retaining the original meaning: to include "all those plant forms that hug the earth closely in defiance of sun, wind, water and ice, whether woody or herbaceous, tiny or widespreading, taprooted or otherwise." This implies a harsh situation but also allows any such subject from well below the alpine zone, as long as it meets the definition. With Bob Woodward, MacPhail collaborated on a recent book

on plant exploration, *In Search of American Alpines*.

Albert DeMezey discussed the various aspects of hybrids that occur in nature, as occasional pollinations or as "hybrid swarms," sometimes indicative of ingression between two or more distinct species. He pointed out that it is here that plant hunters may often find novel individuals of considerable interest and value. "The Case for Hybrids" was presented as a rebuttal to the often-expressed purist attitude that "hybrids are not allowable."

Dennis Thompson, who teaches horticulture at Edmonds Community College near Seattle, presented "The Asteraceae." For an advanced degree at Oregon State University he studied northwestern high alpine asters, now properly referred to as Asteraceae. It became evident that this plant family harbors some overlooked but worthy subjects for rock gardening.

"*Lewisia*" was treated as a photographic essay by Linda K. Wilson. This strictly American genus has contributed much beauty to the rock gardens of the world. *Lewisia tweedyi* Rob. found only in the rockslides of the Wenatchee Mountains of central Washington is without question one of the most beautiful of the *Lewisias* and would rank near the top of any list of the best alpines. Her essay reflected the new cytotaxonomic treatment by Dr. Janet Hohn.

Pauline Croxton of Placerville, California presented "*Violas*," some of her favorite wildflowers and a genus worldwide in incidence. She stated America has not only its fair share of the global distribution of violets but some of the most unusual, found from snow-marsh and clinker-lava to woodland and near-desert, the flowers always unmistakable yet not tediously alike. Some are too easy, others maddeningly difficult to grow in the home garden.

Brian O. Mulligan, Wisley-trained and recently retired Director of the University of Washington Arboretum, reviewed dwarf conifers of North American origin.

A Small Rock Garden



There are at least 25 species of coniferous cultivars which are small, slow-growing, or otherwise suited to rock gardens. Most of those Mr. Mulligan discussed are aberrant clones and unique.

Penstemon with more than 200 species was the subject of Roy Davidson's presentation with some emphasis on simplifying the confused nomenclature. Mr. Davidson has done extensive field work on one of the major sections of genus *Penstemon*, the *Dasanthera* or shrubby penstemon. It is likely that the bulk of *Dasanthera* clones in cultivation came from his garden. In October 1976, Roy Davidson who was Program Chairman of the Wildflower Conference visited Colorado — one of his objectives was to encourage the formation of the Rocky Mountain Chapter of the American Rock Garden Society. Panayoti Callas saw to it that he viewed Mt. Evans' alpine tundra vegetation. Mr. Davidson will return to Colorado in June in order to study and photograph alpine wildflowers. He is keenly aware that there are a number of Rocky Mountain wildings that have not been introduced to cultivation.



Conifers & Deciduous Trees Add to Interest

Versatile Viburnums

Jane Silverstein Ries

Viburnums are ornamental, deciduous, woody plants, grown for their attractive flowers, fruits, and foliage. For an identifying characteristic, the leaves are opposite and usually deeply veined. There are 120 species. Worry not, I shall list only a few that I know do well in the Denver area.

Starting with the earliest to bloom: *Viburnum fragrans*, Bge. similar to *V. x bodnantense*, 'Pink Dawn'. This variety

starts blooming in small pink and white clusters in February before the foliage appears. The blooms are usually nipped by frost in our haphazard climate. They will struggle to have a sparse second bloom in late March or April. This shrub attains a height and spread of about 6-7 feet.

Next are: *Viburnum carlesii* Hemsl., mayflower viburnum, grows to 4-5 feet with larger pink and white, very fragrant,

full flower heads. *V. burkwoodii* Burkwood is very similar, along with a newer and larger flower variety, *V. x carlcephalum*, fragrant snowball. These grow 6-7 feet and bloom along with their foliage, about the end of April and in May. I had a *V. carlesii* Hemsl. which didn't survive, but 2 years later along came a *V. dentatum* L., on which, evidently, the *V. carlesii* was grafted. I like the *V. dentatum*, arrow-wood, as the whole shrub is fine textured with smaller foliage coarsely dentate reaching a height of only 5 feet. In a moister climate, I understand, it gets up to 12 feet. It is not sweet scented but has beautiful fall color and black fruit.

Next are the well known snowballs, blooming the end of May. *Viburnum opulus* var. *roseum* (sterile) L. has large, round, white flowers and no fruit. *V. opulus* var. *americanum* Mill. or *V. trilobum* var. *americanum* Marsh, high-bush cranberry, the foliage is similar on both, has three distinct lobes but the flower is flat, a single form of the snowball. This one has lovely bright red berries in September, hence the name. The birds do not seem to eat them, so they remain all winter. Both shrubs grow to 10 feet. There is also a dwarf, *V. opulus* var. *nanum* Jacq., dwarf cranberry bush, growing to 2 feet with a 30 inch spread. This shrub is slow growing and seldom flowers.

Viburnum lantana L., wayfaring tree, blooms in June and has a flat cream colored blossom. The fruit is very attractive, having yellow, red, and black berries at the same time in a large cluster. It is a compact, dense, 8 foot shrub. The leaves are wrinkled above, tomentose beneath, and turn a good, dark red in the fall. A similar, much larger variety is *V. seiboldii* Miq. It reaches a height of 10-12 feet and has more open growth and a not too pleasant odor.

Viburnum lentago L., sheep berry or nannyberry, is the largest of the

viburnums, growing to 30 feet. This variety can be pruned as a single trunk small tree. It has very lacy, creamy white flower clusters and is the latest to flower, about the last of June, followed by oval bluish-black fruit with bloom. The foliage is quite shiny and turns the most brilliant of all the viburnums. This variety sometimes sends out runners which should be controlled.

Viburnum tomentosum Thunb., double file viburnum, has a striking character, the branches giving a horizontal look with very flat single blossoms. I do not know of many specimens in this area.

I am sure more varieties will be used, since the viburnums are a great addition to our shrub repertoire. They do well in sun or shade, having interesting flowers and fruit and excellent fall color. They are free from insects; the only one bothered is the snowball, which can have aphids. What more could one expect?

Viburnums are a delight; give them a place in your landscape design. If you know of any other varieties doing well in the area, let us know.

Viburnum americanum Mill.



Self-Guided Tour in 9th Street Gardens

Dave Luebbers

Eager for fame and fortune, William G. Russell and his friends from Georgia founded Auraria on the west bank of Cherry Creek near its junction with the South Platte River in October 1858. When Auraria merged with its rival across the creek in April 1860, Denverites wrote home about their thriving prairie outpost. Soon, young immigrants from northern states were rubbing shoulders with immigrants from Ireland, Germany, Poland, and other distant lands. Mexican-Americans arrived from the Southwest as America approached the First World War. As the suburbs embraced the 20th Century, Denver quickly outgrew Auraria and its Victorian setting. By 1965 Auraria was a blighted area owned by absentee landlords and lacked the strength of its pioneer convictions. Auraria was dying.

To breathe new life into Auraria and central Denver, most of Auraria was bought and leveled, making room for a 169 acre campus to be shared by the University of Colorado at Denver, Metropolitan State College, and Community College of Denver at Auraria. Auraria Higher Education Center (AHEC) is the landlord of the \$73 million facility that can serve 33,000 students enrolled in vocational and professional classes. Academic buildings are designed with a low profile so that surviving historic structures can withstand the visual impact of a modern campus. Enhanced by resourceful faculties and crowded with athletic fields, parking lots, bike paths, and a growing arboretum, the Auraria Campus offers attractive educational opportunities centrally located in the heart of Denver.

Historic Denver, Inc. Re-Cycles Old Houses.

Desiring to preserve some part of Auraria's historic and aesthetic landscape, Don D. Etter proposed in 1972 that a block of middle class houses located on Ninth Street between Champa and Curtis Streets be adaptively restored for use by AHEC. His proposal received mixed reviews at first, but through the enthusiastic support of Historic Denver, Inc. (HD), America's second largest private preservation organization, the oldest block of residential houses left intact in Denver was restored. In order to stop the bulldozers, HD raised \$900,000 to complete this unique urban conservation project. A thousand volunteers gave time, money, and expert help while fire, vandalism, and inflation tripled the cost. After four years of hard work, HD wrapped 13 houses in an arboretum and presented the Victorian Park to AHEC for use as offices. Perhaps a modern office building could fulfill the same function at less cost, but it would mean the destruction of these precious homes. On Colorado Day, August 1, 1976, Ninth Street Historic Park was dedicated, not as a museum, but as a useful part of Auraria Campus. Now, all of the faculty members want offices here.

Naturalistic mass planting of tried and tested plant material characterizes Auraria Campus, a style vaguely reminiscent of S. R. DeBoer. Shade trees cool buildings and pavement during hot summers while evergreens cut cold winter winds. A varied mixture of trees, shrubs, and flowers combine in a vertical and seasonal arrangement to provide color, texture, screening, and accent to the unique cooperative campus. The potential for faculty, student, and community involvement in this evolving outdoor laboratory is great. While walking across campus, observe how the fledgling arboretum will meet the physical, educational, and aesthetic needs of the campus.

① The Tour starts at The Mercantile, a converted two-story red brick corner grocery store designed by F. C. Eberly in 1906. Try the beer and pretzels in the rathskeller or sandwiches on the upper two floors. At press time, it is closed on Sundays.

This corner site was once occupied by a wood frame house built during territorial days. Pioneer lumber and windmill merchant Lucian J. Webber lived here before journalist Albert Schuenemann arrived. Jeweler Charles Roth stayed for a short time, then moved on to become a State Representative. Before Albert B. Groussman built the grocery store, his family resided here. After Albert died, widow Belle kept the neighborhood store open until 1965.

② Follow the red sandstone sidewalk to the patio at the rear where backyards are open to view now that barns, vegetable gardens, fences, clothes lines, and garages are gone. The Park is separated from nearby academic buildings by a hedge of lilac, buckthorn, spirea, and euonymus at ground level and evergreen, cottonwood, and hawthorn at upper levels. As the hedge matures, it will enhance the residential character of the Park while adding color, screening, and shade throughout the year. Notice how the kitchens and bathrooms stand out, late 19th Century additions made possible by sewer facilities.

③ The open backyard of the Davis House, 1068 9th, is separated from the parking lot by honeysuckle and juniper. Cottonwood, elm, spruce, birch, and ash provide interplay of texture, shade, and color above. A mature green ash brings a sense of scale to the historic environment.

Residential Nature Emphasized

④ Notice how the landscape design emphasizes the private nature of each house. Flower beds containing thousands of annuals planted by Camp Fire Girls and garden club volunteers set off each house. The decorative iron fence anchored to a low red sandstone wall separates the houses from the tree lined street.

Charles Roger Davis built 1068 9th in 1871, a cubical Italianate villa with projecting bracketed eaves and trellised porch. Born of influential Welch stock in Chester County, Pennsylvania, he gained experience as a miller in St. Louis and Warsaw before departing for Colorado Territory by train in 1870. Enroute to Denver, his daughter Annie Kate was frightened by buffalo herds. When they arrived in Denver, they discovered a vigorous village of 4,800 people that was destined to be a crowded city of 36,000 people within a decade. Recognizing the opportunity, Davis bought a half interest in the Whittemore Flour Mill located a block away. Rebuilding and renaming it, Davis tried to keep pace with business. Meanwhile, Annie Kate went to

Wolfe Hall, the finest girls' school Denver had to offer. When she married Stephen Knight in 1881, her parents built them a house at the end of the street, 1015 9th. Both families lived on the block until the 1900s while the husbands expanded their milling and elevator businesses.



The O'Fallon Victorian Garden complements the Knight House

William Cowe designed 1056 9th for Maurice C. Dolan in 1901. It is a typical turn of the century Denver bungalow, characterized by a central dormer window, hip roof, tall chimney, and broad front porch supported by neoclassical columns. When Dolan arrived in Denver many years earlier, he was given a job by an old Irish friend, John K. Mullen, owner of the Hungarian Mills and founder of Colorado Milling & Elevator Co. Dolan became its treasurer and later, bean department manager. For three months during 1976, the Dolan House served Lew Hammer and Walt Draffin as their landscape office on 9th Street. On this site formerly stood a three room wood house built by Henry Cole during territorial days. When Francis P. Willson moved out, Denver & Rio Grande Railroad conductor Charles L. Rogers moved in.

The Centennial House, 1050 9th, may have been built by Henry Cole in 1876 when Colorado was admitted to the Union, or earlier. The asymmetrical plan of the brick cottage was popular in the Territory during the 1860s and 1870s. Notice the two doors opening onto the side porch, one giving access to the older south half. Tall elegant windows, a fine reconstructed porch, and wood shingles accent the house.

Henry Cole and his wife lived here for four years, then moved to the Smedley House down the street. Francis P. Willson moved his family to 1050 9th from next door in 1880. Willson came to Denver in 1870 riding his own locomotive, perhaps the first in Denver. Born near Toronto, Willson learned his railroad skills in Canada before moving to Chicago, St. Louis, and points west. In 1868 he married Mary E. Robbins in Kansas, then fought Indians for the right to lay track across the prairie. Joining the D&RGRR, he pushed towards Utah, leaving his family in Denver. After her parents died, daughter Mary lived here until 1927.

⑤ Take a seat on the bench beneath the old honeylocust. From this spot you can see Mount Evans to the west, four new additions to the Centennial House, and St. Elizabeth's Church rising above the compact facade of historic houses to the east. Impromptu football games are possible in the open space created by the Park's informal design. Three houses and one printing shop stood here before vandalism, fire,

and bulldozers removed them. Various families lived in this area during the last century, including: Lewis A. Curtice, City Assessor; Francis M. Davis, founder of the Davis Iron Works; Francis W. Blood, Davis' treasurer; George J. Germain, grain dealer; Mike Hilger, saloon keeper; Robert F. Edgar, stonemason; Edwin Vickroy, railroad engineer; Coleman Lydon, brakeman; and Oscar Roop, stock dealer. Nannyberry, honeysuckle, cottonwood, and spruce form the perimeter of the Park to the south.

⑥ The Roop House, 1024 9th, was built in 1875 while Oscar and Cedelia Roop waited next door. Elegant high windows and a tall doorway grace the two-story cubical Italianate villa. Like that used in many brick buildings of the period, the brick was locally produced from poorly fired clay of inferior quality. Notice exposed to the left of the door the unpainted single brick that crumbles to the touch. Please don't try it. Part of the foundation lies above the freeze line, subjecting the house to periodic destructive upheavals. Restoration was not easy.

Roop was born in Toledo, Ohio, and came to the Territory in 1860 driving a team of oxen from Leavenworth, Kansas. He helped install a water stamp-mill for crushing quartz gold ore at Idaho Springs and build U.S. Army barracks at Camp Weld before returning to take a wife in Iowa. Back in Denver, Roop worked in the wholesale liquor trade, then settled down as a stock dealer. During the Spanish American War, he took charge of Denver's stock yard. After the Roops died, the neighbor's son, Albert J. Cole, moved in with his new bride Ethel. Cole became president of Famous Water Elevator Co., a local irrigation machinery firm. From 1903 until 1915, saloon and restaurant owner Peter Austgen occupied the Roop House.

The Smedley House, 1020 9th, was built by Dr. William Smedley following his marriage to Mary Vickers in Pennsylvania on July 4, 1872. Smedley was raised in the same county as Charles Davis, but headed west for his health in 1862. After seeing the Oregon Territory, he returned to complete dental school in Philadelphia before starting his Denver practice in 1870. Their first child, Annie, was nearly kidnapped by Indians while on a family outing in the mountains. Later, Annie's Quaker mother saved her again when she fell down the cellar well. Meanwhile, Dr. Smedley started Colorado's first dental health care service. Later, he served as the first president of both Colorado State Dental Society and Denver Dental Assn. Apparently, prairie living cured his illness, permitting him to practice dentistry until his 90th birthday.

When the Smedleys moved to north Denver in 1880, Henry Cole moved his family here. Cole had worked as a carpenter for eastern railroads before D&RGRR hired him as carpentry foreman. A few years later, he switched to real estate, acquiring a sizable personal estate that included 200 lots, 100 houses, and various gold mines. In 1902 he set up the Peniel Trust Assn. in support of evangelical and missionary activities of the Methodist church with his son as chief executive officer. Mrs. Cole took him to court. The Trust floundered and finally went broke in 1937.

During the Great Depression, Ramon and Carolina Gonzalez bought the Smedley House and created one of Denver's most famous Mexican restaurants, the Casa Mayan. As a cultural center for Mexican-Americans, Latinos, and enthusiastic metropolitan crowds, the Casa Mayan provided fine guitar, dance, song, and discussion groups of the American Southwest. It closed on Oct. 31, 1973.

This plain clapboard house with its elegant eave brackets, millwork door, and etched glass windows was remodeled at least four times. It is one of the oldest surviving frame houses in Denver, complete with two front doors sheltered by a delightfully reconstructed porch.

⑦ As you walk to the corner, notice how honeysuckle, nannyberry, and cottonwood delineate the Park. Juniper covers a berm curving to the west, shielding the Smedley House from street noises. A spruce grove carries the curve to the rear where French doors open onto a brick patio in full view of the Front Range.

In the vacant corner site once stood a territorial house used by various families during the 19th Century, including: Mrs. Clara W. Messenger; tinsmith John Curren; Lucian L. Moore, owner of Moore Hardware & Iron Co.; Ben L. Berkey, mining and milling expert; and the Augustus Andersons, carriage makers. Mrs. Messenger's father, James Hervey Wood, died of smallpox here, and was buried immediately according to health regulations.

Amphitheater to be Cultural Center

As you cross the tree lined street to the Amphitheater, notice that grass has replaced an asphalt pavement, committing the Park to pedestrian enjoyment while emphasizing the scale and visual aspects of the residential neighborhood.

⑧ The Amphitheater can be used by small musical and drama groups playing to select audiences. The area is sealed off to the north and east by the Knight House and Zonta Garden. Naturalistic mass planting of hackberry, cherry, tree-of-heaven, plum, and cottonwood some day will provide a dense canopy of color at various levels above while arrowwood, cotoneaster, and cranberrybush fill in the gaps below. A hedge of lilac to the south shields the stage from street movement and light.

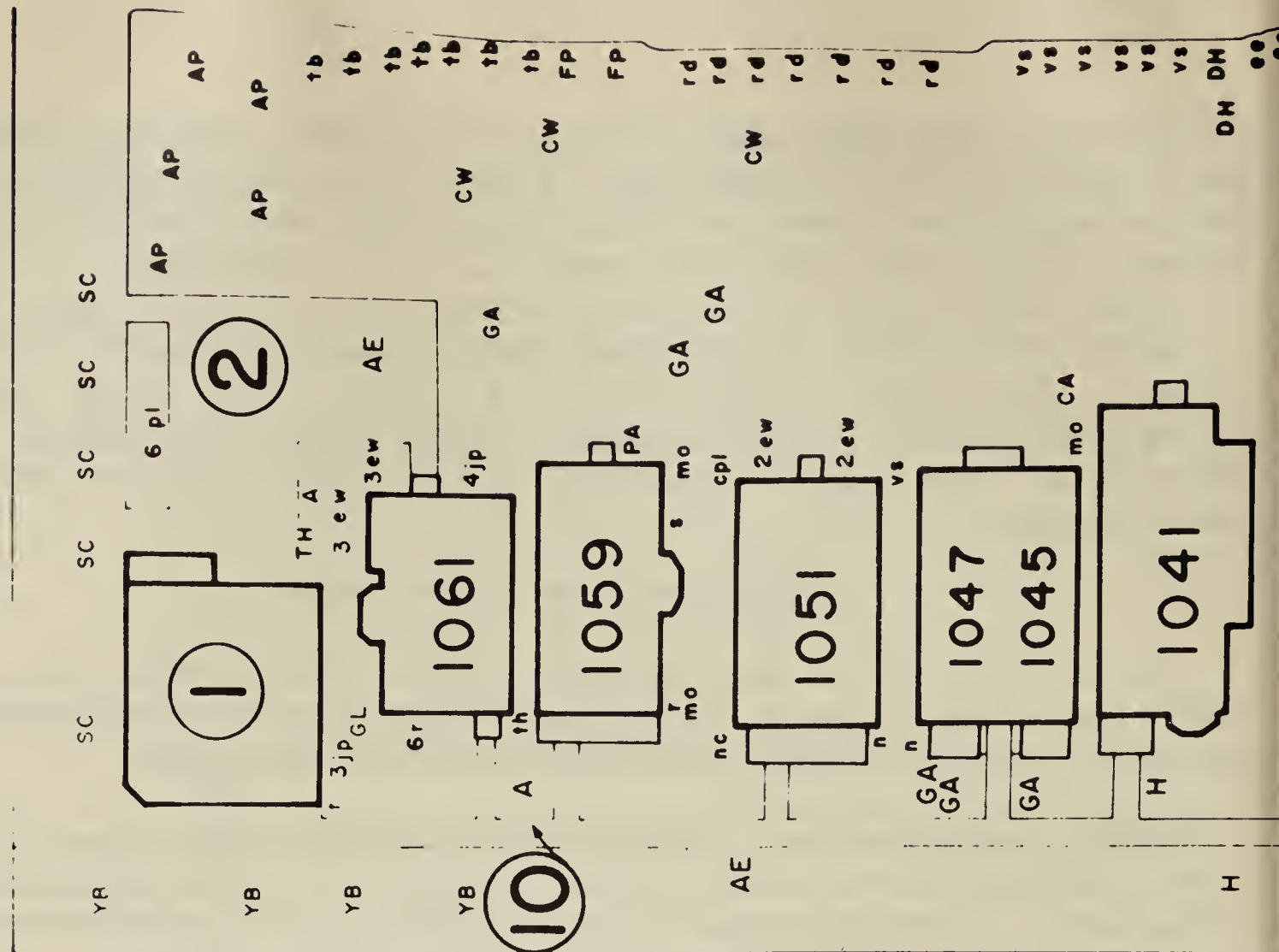
During the last century this site was occupied by small houses that were lived in by carpenter Aaron S. Haines, *Rocky Mt. Herald* publisher William H. Montgomery, rail freight agent Charles S. Gilman, and switchman Thomas J. Mannix. Montgomery was appointed Deputy State Labor Commissioner during the bloody Cripple Creek strike of 1904.

⑨ The O'Fallon Victorian Garden provides a cool comfortable place to enjoy the gurgling fountain, colorfully layered plants, and two mansard roof houses. The garden was once occupied by the Tufts House. Pioneer Hervey Tufts was a tinsmith from Illinois, and his son Charles drove the hook and ladder fire engine. Before Charles was killed by a street car in 1901, the Tufts House gave shelter to marble carver J. E. Byrnes, barkeeper David H. Young, and railroad clerk Edward Rosenberger.

Completed in 1885 as a wedding gift for Stephen and Annie Kate [Davis] Knight from her parents, the Knight House, 1015 9th, is described by Don D. Etter as "a perfectly proportioned tinned roof villa, tastefully embellished and one of Denver's all too few Victorian jewels." Knight was born of English parents in New York before they moved to Denver. After attending Denver public schools and local colleges, he worked as a bookkeeper in his father-in-law's flour mill, later becoming its manager. Later, Knight became a member of the Library Commission and served as president of the Board of Education.

Ed Grimes, manager of the Western Iron & Metal Yard, moved his wife, Rachel, and son into the Knight House in 1902. Born in Poland, he came to the Jewish colony at Cotopaxi, Colorado, near the Arkansas River in 1883. Finding it doomed for lack of water, he walked to Denver where he and cousin Jose Washer went into the salvage business. He saved his money to help friends and relatives escape oppression on the Russian-Polish frontier. His nephew Philip Milstein was destined to become AHEC Board Chairman.

STREET



The Nevin House, 1027 9th, may have been built by Jeremiah Gardner for his son-in-law William C. Nevin in 1882. A rare box bay projecting towards the Gardner House, 1033 9th, is located on the north side. Iron cresting and roof molding on both houses were identical before vandals removed them. Perhaps the mansard roof and rare domed tower over the entryway were built a few years later. A skylight was added to the fire gutted brick tower during restoration, allowing light to cascade down an open stairwell accenting a wood banister and exposed brick walls. If the door is open, take a look. These houses are not normally open to tourists because they are business offices now.

The Gardner House, 1033 9th, was built by Jeremiah Gardner in 1873, a year before Denver enacted the ordinance that required use of brick construction for reasons of fire safety. Perhaps the wood shingled tower was added when the brick tower appeared on the Nevin House.

Gardner brought his family from Maine to Denver during territorial days, establishing himself as a carpenter and contractor. Charles O. Kimball, an iron and brass molder, stayed with them for many years, but carpenters Frank O. Russell, John Smith, Thomas Smith, and machinist Joseph W. Hart stayed only briefly. Henry Nienhiser left here to become Director of West Denver Public Schools. Gardner's daughter Alice married William C. Nevin in Pennsylvania in 1880 and lived next door from 1884 to 1889. Nevin, a showcase maker, started Colorado's first wholesale candy house, the Nevin Candy Co. The first state legislature of Colorado met in his offices on Blake Street. Civil War veteran Samuel F. Nevin, owner of the Logan Hotel, stayed with Nevin before marrying Mayor Van Horn's sister. John E. Witte, an ice dealer and livery owner, took the Nevin House in 1909. His family kept it until World War II.

Built in 1880 or earlier by Denver Alderman Thomas G. Anderson, the Hannigan House, 1041 9th, is a red brick row house typical of Boston, but uncommon to Denver. Notice the tall windows that accent the bay extending the full height of the house. The shallow porch promotes the urban impression. The house is reported to be haunted by a gentleman wearing a tuxedo and mustache.

The first known occupants of the house were Peter and Rebecca Rider in 1880. He was a teamster from New York. Mrs. Mary Hannigan bought the house for \$1,250 in 1880, then married brakeman George Whitebreck, a German Catholic, in 1881. Store clerk Lewis Cane stayed for two years. Civil War veteran Frank Wheeler lived here from 1886 to 1902. Wheeler was a Denver alderman, member of the Board of Education and foreman of the D&RGRR paint department for 35 years. From 1902 to 1938 the John Griebing family resided in the row house. He made cabinets and furniture.

The Schulz Double House, 1045/1047 9th, was designed by J. J. Backus in 1890 as a \$3,700 speculative investment for William Leahy. William F. Schulz, a bookkeeper at Tivoli-Union Brewery, lived here from 1891 to 1905. Notice the three-dimensional brackets on the porch columns made from milled and turned wood pieces. Stucco was added for decoration.

The Schulz Double House replaced a four room frame house lived in by English surveyor John J. Steavenson whose infant son died of cholera, railroad fireman Frank E. Davis, railroad machinist William Leahy, and coppersmith Joseph E. Cykler.

The Young House, 1051 9th, was built in 1902 for \$2,200. A typical Denver bungalow of the period, it exhibits the same characteristics as the Dolan House across the street. Severe structural faults in the north wall almost prevented restoration. Blacksmith Thomas Young and his family stayed here many years while daughter Kittie gave piano lessons in the front room.

The Young House replaces a territorial wood house occupied by John K. Mullen and brother Dennis, flour mill operators. A half century later, John donated his homestead towards construction of St. Cajetan's Church one block north. Railroad fireman and saloon keeper Thomas Blair, printer Thomas B. White, barbers John and Ed Lynch, and barber Augustus M. Kall lived here, too.



Contrasting architectural styles make a charming residential atmosphere for offices.

The Rundle House, 1059 9th, was built in 1880 for William B. Rundle. It is the third tinned mansard roof house on Ninth Street. The second floor was built about 1885 by architect Frank E. Edbrooke who created a sense of unity by repeating angular patterns in the roof line, roof panels, dormer windows, and porch brackets. An original lattice screen highlights the design.

Born in Ohio, Rundle gained experience as a train dispatcher and telegraph operator in the east before stringing wire in Hong Kong. Unfortunately, the company went broke, stranding him in Asia. By 1876 he managed to get a job as dispatcher for the Kansas Pacific RR. Arriving in Denver in 1879, he associated himself with mining interests while supervising the local telegraph operations of the Union Pacific RR. Before he joined the state legislature as a Republican representative in 1895, Rundle was manager of the Colorado Electric Co., director of the Denver Telephone Co., promoter of Denver's trolley system, and builder of the first telegraph line between Denver and Pueblo. Later, he was an executive with various mining firms. Daughter Alice was a music teacher. Daughter Maria lived in the house until 1942.

⑩ Take a seat on the circular bench beneath the apple tree. The Mystery House, 1061 9th, is the third cubical Italianate villa on the street. An elegant stoop now graces its front, replacing a broad modern porch. The north bay is an older addition.

Perhaps the Lucian J. Webber family built the Mystery House in 1885. Wife Samantha, son Frank and daughter Gertrude lived here in 1897. Bartender Louis A. Roth, executive Charles M. F. Bush, and switchman Joseph J. Kalinsky stayed briefly, too. Perhaps students and faculty on campus will resolve the mystery.

Urban Heritage Survives in Auraria

From this vantage point, look back on the homes of Denver's pioneers and see how they reflect diversity of architectural style. These young pioneers who built Auraria and went on to build Denver brought with them a wide variety of skills, cultures, and desires. Saved from the bulldozers, dedicated to educational improvement, and surrounded by a new arboretum, these few remaining houses join adjacent historic structures to set the mood in Auraria. Notice how St. Elizabeth's Church and Tivoli Brewery dominate the skyline while St. Cajetan's Church reflects the warmth of neighborly good will that once permeated Auraria. Is it any wonder that all historic structures on the Tour are listed on the National Register of Historic Places? St. Cajetan's Church and Rectory would be on the list too, but they aren't old enough yet.

Walk two blocks east to St. Elizabeth's Church at 11th & Curtis. Through the leadership of Father Francis Koch and his German Catholic parishioners, this Romanesque revival church was the first Catholic church consecrated in Denver, only six years after ground breaking on Sept. 6, 1896. Four great bells echoing through Auraria were hung from the 162 foot spire after St. Elizabeth held its first services on Jan. 23, 1898. With the completion of St. Francis Interfaith Center next door, the church will extend its historic mission beyond Denver.

Emmanuel Episcopal Chapel, located one block north and west at 10th & Lawrence, is the oldest standing church in Denver. Reminiscent of an English countryside stone church, this Gothic chapel was under construction when Gen. Custer and his troops died at the Battle of the Little Big Horn. James C. Elms of Boston donated a large share of the \$3,000 building fund in memory of his daughter Emma. Denver pioneer hatter Thomas S. Clayton helped organize the Sunday school mission that gave it support. Bishop John Spalding officiated at the cornerstone rites on Sept. 14, 1876, delivered the first service on March 18, 1877, and received aid during consecration ceremonies from Warden Stephen H. Knight the following September. Outgrowing the chapel, the congregation moved to a new church in 1893. In 1903 Ed Grimes helped buy the abandoned church for the Orthodox Jewish Congregation, Shearith Israel, with Albert Groussman serving as president. Artist Wolfgang Pogzeba converted the synagogue to a studio in 1963. Restored by AHEC at a cost of \$125,000, the studio will re-open soon as a campus art gallery and information center.

One block farther north looms Tivoli Brewery and Turnhalle Opera House at 10th & Larimer. Begun in 1859, the complex was built in stages culminating with the 114 foot blue mansard tower in 1890-2. Following renovation by a private concern at a cost of \$6 million, Colorado's oldest brewery will be re-opened in 1980 with shops, offices, bakery, theaters, German beer garden, restaurant, book store, post office, and much more, all redecorated in Victorian style. Its usable floor space is seven times larger than all 14 historic structures in the Park combined. To the north it overlooks a football field, site of Uncle Dick Wootten's raucous saloon in whose attic the first territorial newspaper, the *Rocky Mountain News*, was printed on April 23, 1859.

Return to the Park by way of St. Cajetan's Church and Rectory at 9th & Lawrence. In October 1924, ground was broken for this red tile roofed Spanish colonial church on land donated by John K. Mullen. Through the enthusiastic support of Auraria's growing Mexican-American population and Mullen's continued generosity, this Denver landmark was consecrated on March 21, 1926. AHEC will use the Rectory for office space, but plans for the church are incomplete.

Survival of these historic landmarks is tangible evidence that Auraria's pioneering spirit is alive and well today. The fledgling arboretum shows how that past can be recaptured for future enjoyment. Next time, bring your friends to see where Denver began.

Author's note: Because data collected from primary research sources vary, the reader may discover alternative spelling, dates, and residency. Also, the arboretum as shown by the landscape map may change to fit the needs of man and nature.

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Landscape Committee, Historic Denver Inc.

Carolyn Etter, Barbara Fritts, Vivian Gilbert, Rena Riffel, Margaret Sikes, Elizabeth Willcockson, Barbara Young, Landscape Architect, Chairwoman.



Auraria campus is located around a restoration of Denver's oldest residential block.

Plant List for Ninth Street Historic Park, September 1, 1976.

TREES

CODE	COMMON NAME	CODE	COMMON NAME	CODE	COMMON NAME
A	Apple	GL	Greenspire Linden	PA	Pink Flowering Almond
AE	American Elm	GR	Golden-Rain Tree	PM	American Plum
AL	American Linden	H	Honeylocust	RA	Rosehill Ash
AP	Austrian Pine	HB	Hackberry	RC	Royalty Crabapple
BC	Bechtel Crabapple	HC	Hopa Crabapple	RJ	Rocky Mountain Juniper
BE	Box Elder	HR	Hardy Rubber Tree	RO	Red Oak
BP	Bartlett Pear	J	Jonathan semi-dwarf Apple	SA	Sungold Apricot
C	Cherry	JGM	Jade Glen Maple	SC	Shubert Chokecherry
CA	Crabapple	JPT	Japanese Pagoda Tree	SE	Siberian Elm
CBS	Colorado Blue Spruce	KC	Kentucky Coffeetree	SH	Scarlet Hawthorn
CT	Catalpa	LC	Lanceleaf Cottonwood	SM	Silver Maple
CW	Cottonwood	MA	Mountain Ash	SP	Spruce
DC	Dolga Crabapple	MC	Montmorency Cherry	TH	Tree-of-Heaven
DF	Douglas-fir	MGA	Moongold Apricot	THL	Thornless Honeylocust
DH	Downy Hawthorn	MP	Monitor Plum	WB	Weeping Birch
FP	Foxtail Pine	P	Pear	WP	White Poplar
GA	Green Ash			YB	Yellow Buckeye
GC	Golden Hornet Crabapple				

SHRUBS

a	Arrowwood	gdp	Gold Drop Potentilla	pj	Pfitzer Juniper
ac	American Cranberrybush	gj	Golden Juniper	pl	Persian Lilac
acr	Austrian Copper Rose	gm	Ginnala Maple	r	Rose Bush
aj	Andorra Juniper	hb	Heavenly Bamboo	rb	Redleaf Barberry
as	Aldenham Spindletree	hc	Hancock Coralberry	rd	Redtwig Dogwood
blh	Blue Leaf Honeysuckle	jp	Jackman Potentilla	s	Spirea
bms	Blue Mist Spirea	lfc	Large Flowered Cotoneaster	sb	Sorbaria
cb	Crimson Pygmy Barberry	li	Lilac	sk	Skunkbrush
cc	Cranberry Cotoneaster	ll	Late Lilac	ss	Snowmound Spirea
cl	Chinese Lilac	lp	Lead Plant	tb	Tallhedge Buckthorn
cp	Common Purple Lilac	m	Mahonia	th	Thimbleberry
cs	Common Snowball	me	Manhattan Euonymus	tj	Tammy Juniper
dh	Dwarf Honeysuckle	mjj	Mint Julep Juniper	vs	Vanhoutte Spirea
ee	European Euonymus	mo	Mockorange	wm	Wax Myrtle
ev	Euonymus		Nannyberry	ws	Western Sandcherry
ew	Euonymus, winged	n	Ninebark	wt	Wayfaring Tree
f	Forsythia	nc	Nanking Cherry	zh	Zabel Blueleaf Honeysuckle

Total 167 Trees 478 Shrubs

Bromeliads: The Undiscovered Houseplants

Lawrence Mason, Jr.

One of the outstanding features of the Boettcher Memorial Conservatory at the Denver Botanic Gardens is its beautiful collection of bromeliads. Although not commonly recognized by the amateur horticulturist, the Bromeliaceae often rival the orchid family in beauty during their flowering periods, but have the added advantage that when not in bloom, they are attractive, regal plants. Some have such remarkable markings, patterns, and colors on their leaves that when they do bloom, it seems like an unexpected, added bonus. The bromeliads need not be known only to owners of greenhouses, for with proper care, they can make extremely rewarding houseplants.

Botanically speaking, bromeliads are monocotyledons with three-petaled, showy flowers. Although not part of the definition, their leaves usually form a rosette, spreading regularly from a central point. This shape forms a cup in the center which catches, holds, and administers water for the plant. Within this rather broad definition are many diversities. The fact that the common pineapple and the magnificent festooning Spanish moss are both bromeliads serves to illustrate this point. Size may range from 1 inch to 35 feet, and there are primarily three modes of growth. Epiphytic bromeliads grow attached to trees, saxicolous plants cling to rocks, and the terrestrials naturally are found on the ground.

The flower spike (inflorescence) is often a riot of brilliant contrasting colors.

A good example of this is *Aechmea cylindrata* Lindman. Its inflorescence is composed of over a hundred flowers on a 6 inch spike. The floral bracts are bright magenta, the flower petals are bluish-violet, and the fruit is brilliant rose. The individual flowers on bromeliads rarely stay open longer than one day, but the spike and/or its fruit often remain in brilliant color for six months or more, as in *Aechmea fasciata* (Lindl.) E. Morr.

Unless one takes a trip to the tropic jungles, the best place in Colorado to see bromeliads in a natural setting is at the Denver Botanic Gardens. On a walk through the conservatory, you may have spotted some beautifully-colored, often flowering plants clinging to the tall trees. Actually, they are epiphytes. Their roots simply grab for a foothold and do no harm to the host. Normally, nourishment for these epiphytes comes from whatever happens to fall into the cup of water held by the leaves. Bacterial action breaks down this material, releasing nutrients for absorption by the plant.

The next time you walk through the conservatory, keep your eyes skyward. On almost any large tree, you will see a clump or two of bromeliads. Bromeliads bloom there throughout the year, so no matter when your tour is, you are likely to see some flowering. From the transitory brilliance of *Billbergia x windii* to the scarlet flower spike of *Aechmea distichantha* Lem. which may last longer than eight months, the conservatory bromeliads will dazzle you.

Many people doubt their ability to raise bromeliads successfully in their homes. However, all that is needed for their culture indoors is an understanding of the natural conditions in which they thrive. You will have to provide some humidity and moving air. Fertilizer should be given in extremely dilute form or not at all. The light and water requirements differ by the species of plant but range from full sun and low moisture for *Dyckias* and *Orthophytums* to full shade and constant dampness for *Nidulariums*. The potting mix should contain a high proportion of organic material and must drain quickly. Bromeliads detest standing water around the base, and may die because of it. The Denver Botanic Gardens recommends a mixture of one part medium-grade orchid bark, one part base bark, and one part Peat-lite soilless mix. A good temperature range for most bromeliads is 60 degrees at night and 80 degrees during the day.

The single most important cultural tip is to keep some water in the natural cup formed by the leaves. Most bromeliads can survive with no roots whatsoever if their tank of water is kept filled. They are then able to absorb water as they need it from this storage supply.

Almost without exception, a bromeliad will bloom only once, after which it will gradually die. This process may take several years, during which the plant sends out offsets (pups), to continue life. These offsets can be detached, usually when they are approximately one-third the size of the parent, and go on to bloom in a year or two on their own. A mother plant usually sends out from one to six pups, depending on the size and health of the mother. So, after a bromeliad blooms, you needn't worry about losing it. Your collection will simply expand.

Bromeliads can be purchased locally at most nurseries, or by mail-order from many sources, some of which are listed at the end of this article. Also, some local

enthusiasts are willing to sell or trade offsets from their own plants. The best way to find out about these and other sources is to sit in on a meeting of the High Country Bromeliad Society. Meetings are held on the third Monday of each month at 7:30 P.M. in Classroom B at the Denver Botanic Gardens. Visitors are always welcome, but should be warned in advance that one bromeliad leads to more.

Mail-order bromeliad sources that I have found reliable: Cornelison Bromeliad Nursery, 225 San Bernardino St., N. Fort Myers, FL 33903; His 'n' Hers, 2112 W. Carol Dr., Fullerton, CA 92633; Kent's Bromeliad Nursery, 6518 Bedford Ave., Los Angeles, CA 90056; North Jersey Bromeliads, 15 Douglas Dr., Hillsdale, NJ 07642; Seaborn Del Dios Nursery, Box 455, Escondido, CA 92025.

Aechmea cylindrata Lindman



Exotics of COLORADO

Sycamore

Platanus occidentalis

Helen Marsh Zeiner

The sycamore or plane tree, *Platanus occidentalis* L., is an interesting exotic to be seen in the Denver area along streets, in parks and cemeteries, and on private grounds. Some of these trees have been growing in Denver for a long time. Some very nice specimens along Marion Parkway south of Alameda Avenue were planted in 1912-1913 by S. R. DeBoer who was experimenting with different kinds of trees because he felt the city was planted with too many American elms. He chose sycamore because of a specimen in Washington Park which looked hardy. Another old planting of sycamores is that along a drive southeast of the Museum of Natural History in City Park. This drive was at one time called Crony Lane, and the trees were planted by a group of pioneers who called themselves the Old Cronies.

Sycamores in the Denver area have their problems. They often become chlorotic in alkaline soils, but if you can maintain a neutral soil they will grow well. Sycamores are also subject to anthracnose which causes loss of leaves.

As a control, spray with a fungicide as the leaves unfold. Sycamores add variety with their unusual bark, foliage, and ball-like fruits, and are worth trying in spite of their possible problems.

Sycamores can easily be recognized by their unique bark, which is thin and smooth and on age separates into thin plates which peel off the trunk exposing areas of whitish, yellowish, or greenish inner bark. Branches appear white, more or less mottled with patches of gray. Bark at the base of the trunk on old trees becomes roughened or fissured and scaly.

The large, broad leaves are simple, alternate, and palmately lobed with three to five lobes. Leaves are sometimes 4 to 10 inches long and equally broad. They are said to be the largest simple leaf native to the American forest. The petioles have a broad, hollow base which completely covers the conical bud of the next season.

Flowers are inconspicuous, but the fruits are very noticeable. They are dense balls made up of many hairy, one-seeded nutlets. Each ball is borne at the end of a

long, slender stalk. Fruits add to the interesting appearance of the tree as they hang on during the winter, to break up gradually and be scattered by the wind. The seeds must have moisture to germinate and grow. Because of the fruits, sycamore is sometimes called button-wood or button ball tree.

Platanus occidentalis has a natural range throughout the eastern half of the United States from southern Maine to southeastern Nebraska, south into Texas and along the Gulf of Mexico to northern Florida. It is a tree of low ground habitats, found principally in low ground along streams and about lakes and ponds. Although it prefers moist soil, it adapts to dry soil.

In nature, sycamore becomes an immense tree. It is said to attain the largest diameter of any deciduous tree of the United States. Both Indiana and Ohio have reported sycamore as the largest tree in the state. Indiana has had the distinction of having the largest living sycamore in the United States, a tree which in 1915 measured 43 feet and 3 inches in circumference at 5 feet above the ground. In 1827 it was reported that a hollow sycamore in Indiana stabled 14 head of horses at one time, and that you could easily turn a 14 foot pole in the cavity. In Ohio, it was reported that in 1808 thirteen men on horseback rode into the cavity of a hollow sycamore, with room for two more.

Sycamores are often hollow, a condition believed to be caused by injury to the tree in early life from floating ice and debris starting inner decay. The pioneers used hollow logs in which to smoke their meat. Sections of hollow logs about 4 feet long were used to store grain and were called "gums."

Platanus occidentalis belongs to the family Platanaceae, a family with one genus of trees and half a dozen species found in southeastern Europe to India and in North America. *Platanus* is the ancient Greek name for the plane tree.

Occidentalis means western. *Platanus occidentalis* can be distinguished from the non-American species occasionally seen as ornamentals, because in *Platanus occidentalis* the seed balls occur one on a stem; in the other species there will be two or more balls on a single stem.

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Sycamore — Leaves and Fruit



Weather Vanes as Garden Ornaments

Lorraine Marshall Burgess

More gardeners each year are learning which way the wind is blowing. This is because they are taking weathervanes off rooftops and installing them in their gardens as ornaments. Those lacking access to rooftop roosters are scouring antique shops and junkyards looking for these charming remnants of the past. The acquisition of a weathervane of one's own is a pleasant pursuit.

The weathervane is one of history's oldest forecasting instruments. It rides freely and bravely on a finely balanced upright rod, and is designed to swing free and to face the oncoming wind. While a rooftop may be windier, a garden is breezy enough for the pleasant turning of these wind creatures.

The rooster, long the symbol of vigilance, is by far the favorite weathercock design. Even Longfellow wrote of this spinning device. "He saw the gilded weathercock/Swim in the moonlight as he passed." This gentle word picture is more kind than the dictionary which lists weathercock as a derogatory term referring to a fickle and changeable person. But no matter, today's gardeners have taken a fancy to weathervanes and are installing them in their gardens.

For the gardener who doesn't like the rooster, there are many other choices to consider. Birds, fish, insects, and banners are traditionally favored. Horses, ships, whales, and even grasshoppers are considered appropriate subjects. He who can't find a weathervane that expresses the real "me" can fashion his own design or hire a metalsmith to make one for him.

If you are thinking of making your

own, don't worry if your art talents are limited. Primitive and archaic designs are highly prized. The prime requirement is that the instrument be slender and finely balanced on an upright rod with the rear end heavy enough to swing away from the wind. Early vanes were made of two thin sheets of metal, hammered and shaped outward, and joined on a center seam. Others were silhouette-cut from somewhat heavier metal, and the crudest ones were lightly carved from planks of wood.

Many vanes are balanced above a collar marking the cardinal points of the compass. Legend has it that the word 'NEWS' comes from all directions, north, east, west, and south. The expert collector learns to identify his finds by the artist's style, construction methods, and the kind of type-face used on the cardinal points.

On the east coast there is a sizable concentration of weathervane connoisseurs and collectors. One has been known to buy an entire building to obtain the weathervane on the roof. There is also a number of skilled thieves who use helicopters to lift vanes off rooftops and market them in antique shops. One such pilferer had the bad judgment to try to sell a choice vane to a man vacationing in Florida, who recognized it as an ornament from his own home in New England.

Weathervane subjects are beautiful and legion. The cod and the pike, with arrow-like forms, are symbols both of Christianity and of industry. Horses have been portrayed in many ways, running, trotting, or jumping, and with fire engines

and the country doctor's buggy. The American Indian was shown in many poses. Vanes were used as business identification signs with such symbols as a fire man's hat, a locomotive, and a trolley, even a quill for scholars. The Yankee Stadium was topped with a baseball and bat. Dairy animals, close beside lightning rods, protected huge barns in prosperous farm country. Each was a symbol or totem having personal meaning to its owner. Many of these symbols still have meaning to a gardener.

One of the most appropriate relics from the past is the butterfly vane of

sheet metal and steel. It points the wind direction and seems to flutter in the breeze. Museum examples, unfortunately, often contain buckshot holes in memory of the vandals of previous generations.

In the garden, vanes can be mounted on stone walls, platforms, or tall rods. They give excitement and vitality to a garden scene and pleasure to their owners. If you wish to pursue the matter further, look up Ken Fitzgerald's book *Weathervanes and Whirligigs* suggesting hundreds of designs. It also lists principal manufacturers making weathervanes today.

Weathercock — a-Doodling in a Garden



Aven Nelson

Pioneer Botanist

Ruth Ashton Nelson

Editors' note: This article is condensed from University of Wyoming Publications Vol. XI by permission of the author.

In 1887 a young man came to the young town called Laramie City with the avowed intention to "grow up with Wyoming University." When he arrived in July the first building was only about two-thirds completed. It stood on a barren rise of ground about a mile east of the railroad, and the "city" sprawled over the sloping plain between the tracks and the western edge of the "campus," a campus of native Wyoming prairie, complete with sagebrush and jack rabbits, a campus used as pasture for the local livestock. The first faculty member to arrive on the ground was Aven Nelson, who had been elected by the Board of Trustees, as he supposed, to "the chair of English."

When President Hoyt began to organize his faculty he found he had two professors of English in a faculty of six. Mr. Smith, from Dartmouth, appeared to have had more extensive training and experience in this subject than Mr. Nelson, whose previous experience had been in public school work. So President Hoyt called Mr. Nelson into his office and said to him, "If you can not be Professor of English what would you like to teach? What else have you been interested in?" Mr. Nelson admitted to some interest in

natural history, particularly plants. When he had taught country schools back in his teens he had taken his pupils out into the woods to find spring flowers and as a student at the Normal School he had listened to six lectures on Plant Life. At Drury he acted as assistant to the professor of Natural Science. "That settles it," said the president, "you are the Professor of Biology."

Aven Nelson, born in 1859, had grown up on a farm in southeastern Iowa. Two factors were of great significance in their influence on the character of the little boy. One was the independence and simple, Christian example of his Quaker father and mother; the other, the moral code of thrift, industry, unselfishness and kindness set before all school children of that generation. Aven Nelson, like many others of his generation, quoted verses from the *McGuffey Readers*. From the *Third Reader* comes a favorite which expresses a guiding principle of his life:

The lark is up to meet the sun,
The bee is on the wing,
The ant his labors has begun,
The woods with music ring.

Shall bird and bee and ant be wise
While I my moments waste?
Oh, let me with the morning rise
And to my duties haste.

This seriousness of purpose qualified Aven Nelson, at the age of sixteen, to become the teacher of the little country school which he had attended. As soon as enough money was saved he went to Normal School at Kirksville, Mo., where he completed the four-year course in three years, and on graduation in 1883, obtained a position at Drury College. In 1885 he accepted a position as superintendent of schools at Ferguson, Missouri, a suburb of St. Louis.

When he went to Ferguson in the fall, he took with him his bride, Celia Alice Calhoun, to whom he had become engaged while at Kirksville. Some of the activities of their broadminded principal did not meet with the approval of the school board members. Perhaps their attitude had something to do with his receptivity to the idea of going to a new university in the free and open west.

During his first few years in Wyoming, Aven Nelson learned and taught a good deal about biology. He also taught other subjects, including calisthenics. In 1891 the Experiment Station was established at the university and the professor of botany was named Botanist of the Experiment Station. This added responsibility increased his feeling of a need for graduate study. In 1891 he asked for leave of absence and went to Cambridge for a year. He still had no special interest in taxonomic botany but studied the physiology and morphology of plants and animals. Though he had had no previous formal college training in science and only a normal school degree he was able to earn a Master's Degree in Science.

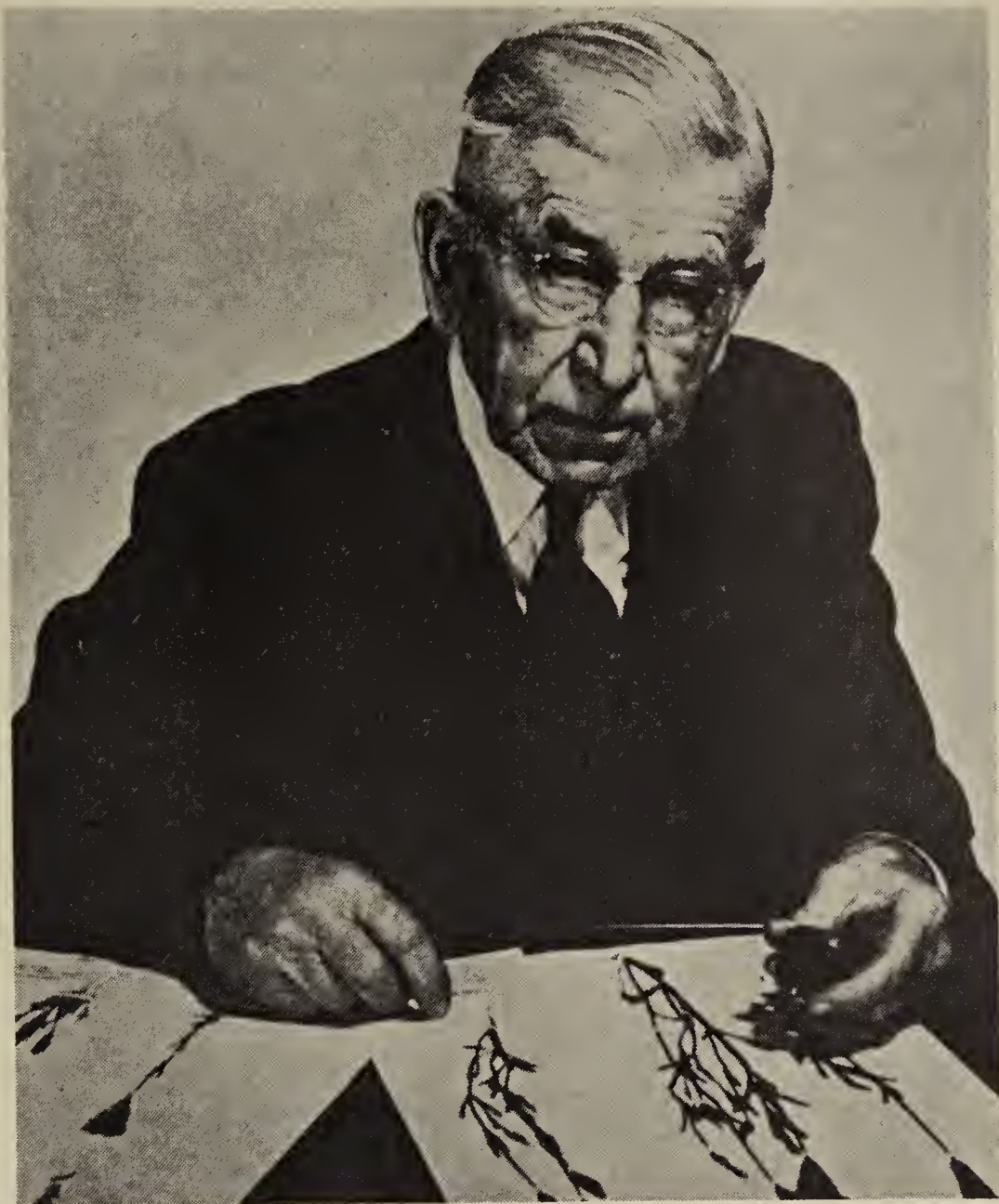
In 1892, Dr. B. C. Buffum, who had substituted for Nelson during his absence, had made a collection of specimens of Wyoming forage plants for the Chicago World's Fair of 1893. When Nelson returned, he found that the disposal of these plants was up to him. Without training or experience in this field and with the most meager equipment, two

inadequate books, an alcohol lamp and a test tube, but with diligence and a natural interest in the phenomena of nature, Aven Nelson entered on the course which was to make him one of the great systematic botanists in the United States.

His reference library consisted of Gray's *Manual of Botany*, dealing with the "Central and Northeastern United States and Adjacent Canada," and Coulter's *Manual of the Botany of the Rocky Mountain Region*, published in 1885. The first dealt with an entirely different flora, and the second was hardly more than a compilation based on the few collections made in this area up to that time by early explorers.

Discovering that the plants he was working with did not fit any of the described species in these books, Nelson became more and more convinced that he was dealing with species previously unknown. In 1896 he timidly offered his first botanical paper to Dr. Underwood, editor of the *Torrey Bulletin*. Its cordial reception encouraged him to further adventures in this field. Soon he was a regular contributor to several of the journals including the *Botanical Gazette* and *Erythea*. During the years 1898 and 1899, a series of papers under the general heading "New Plants from Wyoming," appeared in the *Torrey Bulletin*. Later his published papers were gathered into a volume which was offered as the thesis for the degree of Doctor of Science conferred on Professor Nelson by the University of Denver in 1904.

In 1894 the botanist joined forces with the University geologist, Professor Wilbur Knight, on a summer field trip. With a team of horses, a lumber wagon and a saddle horse, these two professors crossed the state diagonally, camping near the good collecting grounds, living partly off the country, visiting the oil seepages which later made millionaires of lucky men, discovering valuable vertebrate fossils and many new species of living



Dr. Aven Nelson

plants. They traveled 800 miles, to the Jackson Hole country and return.

From 1894 until the time the summer session required his teaching services, Aven Nelson spent every summer in the field collecting plants, sometimes by horse and wagon, sometimes by train and bicycle, later by automobile.

As a result of these trips, the plant collection at the University grew rapidly. It soon expanded beyond state boundaries and in 1899 was designated by the Trustees of the University as "The Rocky Mountain Herbarium."¹

Aven Nelson succeeded in building the Herbarium while carrying a full teaching load. He often said "teaching was my vocation, building a herbarium my avocation." He took his teaching very seriously, always giving to it his best effort and the first demands on his time.

From the affection and appreciation expressed on numerous occasions by hundreds of his former students, one is led to the conclusion that his contribution as a teacher was fully as important as any of his research work. His students are scattered over the continent. There is hardly an institution, of those in which plant sciences are taught or practiced, where there is not to be found at least one who pays tribute to Dr. Aven Nelson. Among the botanists of today who have really achieved, many received their early training and inspiration from him. His scholarly mind and mastery of his subject gained for him prestige and respect, his fairness and his sense of humor endeared him to all who came in contact with him.

In addition to his teaching and research work this man had time for community service. Several different times he carried the responsibility for the

University as acting president. He planned and supervised the planting of trees on the campus, and did much of the actual work himself. All of the early plantings and the groups of large spruces are his handiwork. During these years he wrote, besides his scientific papers, many Experiment Station bulletins.

In 1905 the legislature created a State Board of Horticulture and named the University Botanist as its secretary. From then until 1922, when the Board was dissolved. Dr. Nelson filled this position.

About this time work was begun on the *Manual*, nominally a revision of the old Coulter *Manual of Rocky Mountain Botany*, but actually a new book. So much new information had come to light as a result of the investigations of Nelson and others working on the western flora, that botanical leaders, including John Coulter, were urging him to prepare a textbook of western botany. In 1909 the book came off the press. It was then accepted as the authority on the Rocky Mountain Flora.

Here something must be said in appreciation of Alice Nelson, the wife and mother who kept things running smoothly at home. No husband could have accomplished what this man did without the loving sympathy and support of a poised, unselfish and competent helpmate. On field trips she carried her share of the camp routine and on days of heavy collecting she and the two daughters helped with the plant work. In the president's house she was a gentle and gracious hostess. Her passing in the summer of 1929 was a loss to the community as well as to the family.

In 1917 on the sudden resignation of Dr. Dunniway, Professor Nelson was made president of the university and served in that capacity through the troubled time of the first World War, and until October, 1922.

His interest in science and learning in general led him to promote all organizations and activities that encouraged

them. He had been a fellow of the American Association for the Advancement of Science since 1901 and regularly attended the annual meetings of the Society. He attended three International Botanical Congresses, Ithaca in 1926, Cambridge in 1930, and Amsterdam in 1935. In 1935 he served as President of the Botanical Society of America and in that capacity was a delegate to the Congress. He was instrumental in organizing the Colorado-Wyoming Academy of Science. In 1931 he was elected President General of Phi Kappa Phi, in which capacity he served for four years.

Following his seventieth birthday he was relieved of part of his teaching load. This, to him, was merely an opportunity for more collecting and research work. Gradually his teaching and administrative duties lessened, although he continued to teach at the University Summer Science Camp and to act as Curator of the Herbarium for ten years longer.

In 1930 Ruth Ashton came to Wyoming as graduate assistant in the Rocky Mountain Herbarium. In November, 1931, the Curator and his assistant went quietly to Santa Fe, New Mexico, and were married. From that time on they made plant collecting their main interest. Their travels carried them from Victoria, B.C., to Pensacola, Florida, and from Montreal to Acapulco, Mexico, with side trips to Europe and Alaska. Dr. Nelson remained active and interested in the Herbarium and in collecting until his death in 1952 at the age of 93.

To use the words applied by him to another great man and botanist, "It seems to me that there must have been four words in his vocabulary that are less frequently heard now — right and wrong; conscience and duty."

¹See paper by Dr. Aven Nelson, "The Rocky Mountain Herbarium," *Phi Kappa Phi Journal*, December, 1943. Here Dr. Nelson describes the growth of the Herbarium.

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SUMMER, 1977



THE COVER

Red Bud Tree

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Editors

SUMMER, 1977

High Altitude Vegetable Gardens <i>W. B. Pings</i>	34
"In Happy Memory" <i>Josephine O. Robertson</i>	42
Cotoneaster <i>Chris G. Moritz</i>	43
Cemetery to Conservatory, Part III <i>Louisa Ward Arps</i>	45
Focus on <i>Cycas revoluta</i> <i>Peg Hayward</i>	54
Exotics of Colorado — Musk Thistle <i>Helen Marsh Zeiner</i>	56
Cockerell of Colorado <i>Joseph A. Schufle</i>	58
Looks at Books — <i>Rocky Mountain Flora</i> <i>William G. Gambill, Jr.</i>	63

High Altitude Vegetable Gardens

W. B. Pings

In recent years there has been a major resurgence of interest in gardening, particularly in vegetable gardening. The USDA estimates that in the summer of 1976, for the first time since the victory gardens of World War II, a majority of American households had some kind of a vegetable garden. There has also been a marked increase in community gardening, and in community canning and preserving centers. Gardening in the mountains has of course been part of this trend back to the soil. It is of interest to review some of the reasons for gardening, particularly at high altitudes in the mountains where it is often difficult to grow many of the crops that are relatively easy to manage at lower elevations.

The original impetus for a return to gardening was likely given by the recession, by high food prices, and by the shortage and high price of gasoline, leading many people to spend more time at home. To long-time gardeners, however, the reasons for the continuing interest in gardening are different from the purely economic, and include the following:

- 1) There is pleasure in eating fresh produce from one's own garden, such as beet greens, peas and new potatoes, sweet corn, fresh herbs, and green beans.
- 2) Gardening is a creative art form, and there can be as much satisfaction in planning a garden and seeing things grow as in the more generally recognized forms of artistic expression such as painting, sculpture, and crafts.
- 3) Gardening offers good exercise for all ages, and has an added therapeutic benefit. It is well recognized that tensions tend to diminish when one is working with growing things.
- 4) Gardening basically is an enjoyable activity and is fun even if considerable physical labor is involved, so for many it is a rewarding hobby.

It is the objective of this article to describe some of the joys and frustrations of growing vegetables at high altitudes, and to discuss some of the practical aspects of successful vegetable gardening in the mountains. It is well to emphasize that all growing things have a will to live, that there are few absolute answers to most garden questions, and that there are many ways to grow and enjoy a good garden.

Why Gardening is Different at High Altitudes

One of the first things that the beginning mountain gardener learns is the inexorable effect of altitude on the growing season, that is, on the number of frost-free days, as shown in the following figures. At 5000 feet, there is an average of 138 frost-free days; at 6000 feet, there is an average of 113 frost-free days; at 7000 feet, there is an average of 98 frost-free days; at 8000 feet, there is an average of 50 frost-free days. Of particular interest is the sharp drop in going from 7000 to 8000 feet, where the effective growing season is reduced almost by one-half. The author's garden in Evergreen is at an altitude of approximately 7400 feet.

The growing season also is affected at any altitude by the type of exposure; for example: a southern exposure always will warm up more quickly than a northern slope. The type of air drainage also can be a major factor, since cold air tends to "pool" in low-lying areas and prevent warming. Some examples showing these effects are: Steamboat Springs, at 6,770 feet elevation, averages only 49 growing days; Fraser, at 8,560 feet elevation, averages only 16 growing days; but Leadville, at about 10,000 feet elevation, averages 77 growing days. It must be emphasized that the numbers of frost-free days shown for any altitude are averages, and that the highly specific conditions surrounding a plant in a given location (the so-called microclimate) will determine the kinds of things that can be grown successfully, even if other locations at the same altitude may have considerably different growing seasons. Even when frost is



Growing Pole Beans

not experienced, the cool nights at higher elevations make some of the warm-season crops difficult or impossible to mature properly. As an example, a variety of sweet corn with an estimated time to maturity of 62 days always takes 75-85 days to mature in Evergreen.

There are two basic approaches that may be followed in gardening at high altitudes, depending upon one's personal philosophy: to accept the limitations imposed by altitude, and grow only those things that are known to succeed under mountain conditions, or to wage a continuing battle to make some of the borderline crops succeed, e.g., by providing a modified microclimate. Each type of gardening will appeal to some people, and each approach will have its own satisfactions and disappointments.

Crops for High Altitudes

PERENNIAL VEGETABLES The perennials, although few in number, can be some of the most satisfactory vegetables in high-altitude gardens, and have the added advantage of producing for many years under proper conditions. The major perennial vegetables are asparagus, horseradish, and rhubarb, all of which are very hardy. Jerusalem artichokes are receiving considerable attention, and may be grown up to about 7500 feet, where they produce small crops of tubers. The perennial vegetables should be placed in a separate area so that they do not need to be disturbed in the yearly preparation of the main garden plot. If not disturbed, the perennials will produce for a number of years with a minimum of care.

ANNUAL VEGETABLES The annual vegetable crops are those that are replanted each year, and are the best-known of the garden vegetables. For the higher elevations, the most hardy and accordingly the most satisfactory crops include beets, broccoli, Brussels sprouts, cabbage, carrots, cauliflower, Chinese cabbage, endive, fava beans (English broadbeans), kale, kohlrabi, lettuce, onions, parsley, parsnips, peas, potatoes, radishes, salsify, spinach, sugar peas (snow peas), Swiss chard, turnips, rutabagas, and a number of the herbs. Most of these can be planted early in the spring, and a number of them can be planted in two or more successive plantings throughout the growing season.

One of the most satisfying cool-season crops is lettuce. It may be planted very early in cold, wet soil in a coldframe, and at 2-3 week intervals in the garden during the growing season. By planting in the coldframe in late summer or by moving plants from the garden to the coldframe, fresh lettuce including the various leaf varieties, the loosehead or Bibb type, and in some years the true iceberg or crisphead varieties, may be enjoyed until December.

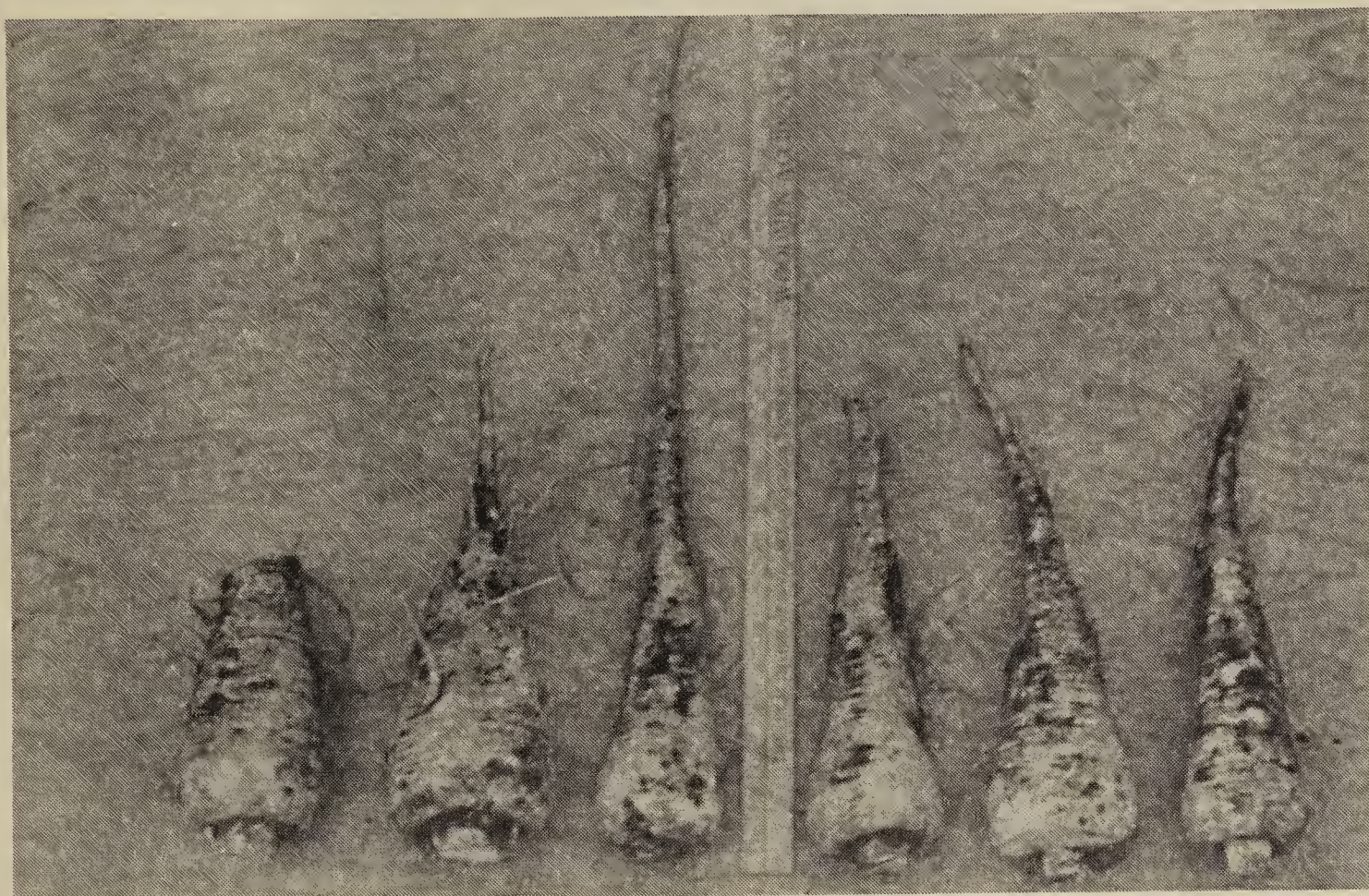
Two of the annuals that are somewhat less hardy but usually productive at least up to 7500 feet elevation are beans (bush and pole) and summer squash. These must not be planted until the ground has warmed and are susceptible to late spring frosts, but usually will produce good crops before the fall frosts.

A borderline group of annual vegetables includes celery (a difficult crop for the home gardener), cucumbers, eggplant, lima beans, peppers, pumpkins, sweet corn, tomatoes, and winter squash. This group cannot be planted in cool or cold soil and appear to be retarded in growth by cool nights, so that often they will not mature crops in the short growing season before killing fall frosts. This group offers a major challenge to the mountain gardener in finding ways to extend the growing season by modification of the microclimate. Thus plants may be started in the house, additional protection given during the growing season by plastic enclosures, clear or black plastic covers used on the ground to assist warming of the soil, or the plants may be placed in specially protected areas (hot spots) near a house, fence, or building. Use of plastic covers on the soil is particularly helpful with corn, cucumbers, and winter squash.

A group of annual vegetables almost always unsatisfactory above 5000 feet elevation includes black-eyed peas, cantaloupe (muskmelon), edible soybeans, okra, peanuts, sweet potato, and watermelon. Unless a greenhouse can be provided, none of these crops will survive the short growing season at high altitudes.

Steps in the Production of Vegetables

SEEDBED A good soil for gardens should contain about 45% mineral matter, 25% air, 25% water, and 5% organic matter. The major need of mountain soils is for organic matter to help hold water and to darken the soil to improve warming in the spring. Mountain soils generally are not the heavy clay soils found in the Denver area, but tend to be granitic and light-colored, so that they do not warm up quickly. As a



Parsnips

general rule, Colorado soils do not require additions of lime, which is often a surprise to first-time gardeners in this area who have come from the east or midwest.

In choosing a garden site, as flat an area as possible should be selected with maximum sunlight exposure. Prime land is that with a 0.5 to 1% slope, i.e., the slope is 6 to 12 inches per 100 feet. The garden plot should not be immediately adjacent to large trees or shrubs, since root systems of these plants will soon invade the garden and will take an inordinate amount of water. Trees to the north and west of the garden but not too close will aid in reducing the drying winds.

The first step in preparing the plot should be to spread organic matter over the selected area. This may be manure, compost, peat moss, leaves, and should be applied every year to maintain the organic content of the soil. Some commercial fertilizer may be applied at this time, but preferably it should be applied later as a side dressing to the growing plants. Any available method of tilling the soil may be used, depending upon the size of the area, whether plowing, spading, or use of a mechanical tiller. After thorough tilling to incorporate the organic material, the area should be raked smooth for planting.

It is difficult to give meaningful information as to yields to be expected because of the many variables such as the productivity of the soil, the amount of fertilizer used, the frequency of watering, and the cultivation practices employed. The size of plot selected also will depend upon the size of family and whether storage or preservation of the garden produce is to be attempted. Approximate amounts of various vegetables to plant per person have been given as 6 feet of row for beans, beets, carrots, kale, lettuce, onions, Swiss chard, and turnips; 12 feet of row for peas; and 25 feet of row for potatoes and sweet corn. Some actual figures for 1976 production in Evergreen are: 146 pounds of Red McClure potatoes from a 40-foot row; 18 pints of Pole Romano beans frozen from four poles; and 56 pints of Kentucky Wonder pole beans frozen from 24 poles (3-5 bean plants per pole). The total yields were considerably greater because of material eaten and given away during the growing season. Beginning gardeners should be cautioned not to attempt too great an area at first; it is better to expand later if the need arises than to be discouraged by too much effort in the first trial.

FERTILITY The major fertilizer elements are nitrogen (symbol N), phosphorus (P), and potassium (K). Nitrogen is that component of a fertilizer that stimulates foliage growth, is very soluble, and moves readily in the soil. Nitrogen is essential for leaf crops such as lettuce, chard, and corn, and is the major constituent of lawn fertilizers. Phosphorus is the fertilizer element that promotes flower and fruit production, is relatively insoluble, and moves slowly in the soil, only about 1 inch per year vertically. It is particularly needed by beans, squash, tomatoes, etc. Potassium (potash) contributes to the development of starches and sugars and to plant hardiness, is relatively soluble, and is generally plentiful in Colorado soils except in some very sandy conditions. It is helpful to potatoes, parsnips, and strawberries; wood ashes are a good source.

When a bag of commercial fertilizer is purchased, it will be noted that three numbers are given, e.g., 5-10-5. These numbers show the percentage by weight of the three major ingredients in the order N-P-K, thus 5-10-5 means that the bag contains 5% nitrogen, 10% phosphorus (as P_2O_5), and 5% potassium (as K_2O). This type of fertilizer, having twice as much phosphorus as nitrogen, is a good general purpose fertilizer for the vegetable garden. Use of a high-nitrogen fertilizer such as 20-10-10 (a standard lawn fertilizer) or excessive use of manure in the vegetable garden will lead to lush foliage growth and minimal fruit production such as on tomatoes.

Commercial fertilizer can be spread before tilling the garden, but it is felt to be more economical to apply it later as a side dressing between the rows. The best time for application of fertilizer is in the early vegetative stage of growth; fertilizer should be withheld in the flowering stage; and the second best time of application is in the fruiting stage. A satisfactory side dressing for most crops in the vegetable garden would be 1/4 to 1/2 pound of 5-10-5 per 50 feet of row, applied early in the growing season. For lettuce, chard, and other leafy crops, small amounts of high-nitrogen fertilizer such as 20-10-5, ammonium sulfate, or ammonium nitrate may be carefully applied as a side dressing. These high-nitrogen materials will burn the foliage if spilled on the plants.

PLANTING As a general rule, the rows in a vegetable garden should run in a north-south direction so that all rows receive approximately equal sunlight during the day. If this is not feasible because of the drainage, tall plants such as pole beans and corn should be put on the north side of the garden to prevent shading the low-growing plants.

It is always advisable to make a garden plan on paper before planting the garden, and to preserve the plan from year to year so that rotation of crops can be practiced.



Varieties of Squash

Even in a small garden such rotation is desirable to prevent a build-up of specific insect pests and to avoid depletion of certain fertilizer elements. It is suggested to plant those vegetables known to be enjoyed by the members of your family, but it is also interesting to try at least one new item each year.

The first planting should be made about 4 weeks before the average date of the last expected frost in the vicinity, and will be the most hardy of the vegetables: broccoli, cabbage, fava beans, lettuce, onions, peas, potatoes, spinach, sugar peas, turnips. In Evergreen these usually are planted the last week in April.

The second planting is put in about 2 weeks after the first planting and includes beets, carrots, chard, endive, hardy herbs, parsnips, radishes.

The third planting should be made 1-2 weeks after the average date of the last expected frost, since it includes the least hardy of the annual vegetables: beans, corn, cucumber, squash (summer and winter), tomato (plants set out). In Evergreen, these are planted about the first week in June.

Successive plantings can be made of lettuce (every 2-3 weeks until about mid-August), carrots and beets (4-5 weeks after the first planting), and broccoli (4-6 weeks after the first planting). Chinese cabbage should not be planted until after about July 1.

WATERING Sprinkling is the most widely used but probably one of the least effective methods of watering — considerable water is lost by evaporation, and it is known that sprinkling can interfere with pollination of some plants such as cucumbers. Irrigation or use of a soaker hose is the best method of watering, the best time is early afternoon so that the plants can dry out before nightfall, and the best technique is deep and infrequent watering. Potatoes are known to require much water but must not become water-soaked, onions need to be kept moist during active growth since they

will stop growing if allowed to dry out, and tomatoes generally need water only at 10-14 day intervals.

A relatively new method of drip irrigation is described in the February 1977 issue of *Flower and Garden*. Basically this method might be considered a refinement of the old soaker hose and involves use of a plastic pipe with emitters at intervals so that the small amounts of water are put very near the growing plants, and a minimum of water is wasted between the rows. As water becomes increasingly scarce and more expensive, this method is expected to become more widely used.

Herbs in the Vegetable Garden

Herbs are an often neglected part of the vegetable garden, but can be widely used in salads and in cooking, so are a valuable addition to the usual variety of vegetables. Fresh herbs are not usually available in supermarkets, so they can be enjoyed only from the garden, and many of the herbs can be dried for winter use. As with perennial vegetables, it is desirable to set aside a separate area for the growth of herbs, particularly since many of these plants require only small plantings and rows can be closer together than in the usual garden layout.

Several herbs have been grown successfully in Evergreen:

Annual — anise, borage, caraway, chervil, coriander, cress (mountain, or pepper grass), Florence fennel, summer savory, sweet basil.

Perennial, but grown as annual — oregano, rosemary, sweet marjoram.

Perennial — burnet, chives, horehound, hyssop, lovage, sage, sorrel, tarragon, thyme.

Several books dealing with the culture and use of herbs are listed in the bibliography.

Lists of Recommended Varieties

The following lists include those varieties that have been successfully grown in Evergreen as well as others that have been suggested for mountain gardens.

Beans, bush: Dwarf Horticultural (shell bean), Bush Romano, Improved Tendergreen, Burpee's Brittle Wax, Richgreen, Blue Lake

Beans, pole: Kentucky Wonder (and KW wax), Pole Romano, Burpee's Golden

Beets: Detroit Dark Red, Ruby Queen, Crosby's Egyptian

Broccoli: Hybrid Green Comet, Greenbud, DeCicco

Brussels sprouts: Jade Cross Hybrid

Cabbage: Golden Acre (early), Early Jersey Wakefield (early), Marion Market YR (midseason), Copenhagen Market (midseason)

Chinese cabbage: Michihli and various hybrids

Carrots: Goldinhardt, Half-Long Nantes, Danvers Half-Long, Chantenay, Emperor

Cauliflower: Burpeeana, Early Snowball, Snowdrift

Corn, sweet: Early Sunglow, Early Giant Golden Bantam, Early Golden Giant Hybrid, Golden Beauty Hybrid, Early Extra Sweet

Endive: Batavian, Green Curled

Kale: Vates, Siberian

Kohlrabi: Early Purple Vienna, Early White Vienna

Lettuce: Grand Rapids, Black Seeded Simpson, Hardy Green Winter, Paris Island or Paris White (Cos), Ruby, Early Prizehead, Salad Bowl, Buttercrunch (Bibb type), Imperial 44 (head), Great Lakes 659 (head)

Onions: Yellow Sweet Spanish, Early Yellow Globe

Parsley: Extra Curled Dwarf, Parsnip-Rooted (Hamburg), Plain or Single (Italian)

Parsnips: All-American, Hollow Crown, Long Smooth Hollow Crown

Peas: Green Arrow, Freezonian, Fordhook Wonder, Blue Bantam, Little Marvel

Potatoes: Red McClure, Norland, Norbest

Pumpkins: Big Max, Big Tom, Connecticut Field, Small Sugar

Radishes: Early Scarlet Globe, Cherry Belle, White Icicle, Crimson Giant, French

Breakfast, Chinese Rose (winter)

Rutabagas: Purple Top Yellow

Salsify: Sandwich Island Mammoth

Spinach: New Zealand (not a true spinach), Bloomsdale, Hybrid No. 7

Squash, summer: Golden Zucchini, Hybrid Zucchini, Yellow Straightneck, Yellow Crookneck, White Patty Pan (Bush Scallop)

Squash, winter: Gold Nugget, Kindred, Blue Hubbard, Table King Acorn

Swiss chard: Fordhook Giant, Rhubarb

Turnips: Purple Top White Globe, Tokyo Cross Hybrid

A forthcoming article will discuss the growing of small fruits at high altitudes.

REFERENCES

The following Colorado State University Extension Service "Service in Action" sheets are available from County Extension offices:

- 5.509 Insect control in the home garden
- 7.214 Mulches for the home grounds
- 7.218 Plant pests in the organic garden
- 7.601 Storage of home-grown vegetables
- 7.602 Saving seed from the home garden
- 7.603 Planning the vegetable garden
- 7.607 Sweet corn
- 7.608 Leafy vegetable crops
- 7.609 Cucumbers, pumpkins, squash, muskmelons, watermelons
- 7.610 Potatoes for the home garden
- 7.611 Fertilizing the home vegetable garden

Books on Herbs

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- Brown, Alice Cooke, 1966, *Early American Herb Recipes*, Bonanza Books, New York.
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Pamphlets

- Bay, Betty, 1974, *Grow Your Own Herbs, Culture, Use*, Pamphlet 122, CSU Cooperative Extension Service, Fort Collins, Colo.
- Moore, Frank D. III, and Hansen, John C., 1974, *Suggestions for High Altitude Home Vegetable Gardens in Colorado*, Pamphlet 158, CSU Cooperative Extension Service, Fort Collins, Colo.

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- Free, Montague, 1937, *Gardening, A Complete Guide to Garden Making*, Harcourt, Brace and Company, New York.
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"IN HAPPY MEMORY"

Pauline Roberts Steele

September 23, 1911 — April 6, 1977



Visitors strolling the paths of England's Kew Gardens find benches offering welcome rest and reflection. Many of these benches were given as memorials and carry inscriptions starting with the poignant words, "In Happy Memory of - - " It is with happy memory that the many friends of Polly Steele look back through their years of working together for the Denver Botanic Gardens.

Polly was born in Stilwell, Oklahoma and came to Denver at the age of 18 for her health. She spent many months in a tuberculosis sanitarium but sheer will power helped her to regain enough strength to lead a busy life.

She and her mother lived at 4935 Raleigh Street and this was her home until her death. She was married for 28 years to the late James P. Steele Jr.

Polly and her mother were interested in flowers, plants, and birds and both became active in the Home Garden Club. Polly had a gift for whimsical sketches and for botanical drawings which were both accurate and beautiful. Her art enlivened and enhanced the pages of *The Green Thumb* for more than 25 years. She served as a member of the Editorial Committee working with George Kelly, Dr. A. C. Hildreth, and many subsequent editors. Her creative talents also found an outlet in the arts and crafts workshop where she delighted the members with her droll nut figures and beautiful wreaths.

Her major interest outside her home was Denver Botanic Gardens. She was one of the founding members of Around the Seasons Club and participated in its activities to the limits of her frail health. Although Polly experienced both pain and heartache in her life she remained a warm and vibrant person. Her drawings catch her sparkling, fun-loving spirit. Those who knew her believe that she would want her friends to carry on her work for the Gardens, to look back on sunny days shared and to think of her always "in happy memory."

Josephine O. Robertson



Cotoneasters

Chris G. Moritz

Out of the large number of species and varieties of *Cotoneaster* only a few have been grown here and fewer yet are readily available in nurseries in the area. Yet we find the various cotoneasters very useful shrubs whether we are looking for a shrub for screening purposes, a plant for free growing hedges, a groundcover, or a rock garden plant.

All cotoneasters available here are among the first shrubs in spring to develop new leaves. Some species retain their foliage through the winter and may be called wintergreen. The leaves are generally small, dark green and glossy and delight us in fall with brilliant orange to dark red color. A display of colorful fruit is common to all cotoneasters, fruit that generally hangs on well into the winter.

All cotoneasters, as members of the Rose Family, are subject to fireblight. However, if infected branches are carefully removed the blight generally can be controlled. In my experience, *Cotoneaster horizontalis* and *Cotoneaster salicifolia* 'Autumn Fire' are more severely affected by blight than many other species.

Cotoneaster acutifolia Maxim., the well known Peking cotoneaster, is a very drought resistant and hardy shrub suitable for screening where an 8 foot high shrub developing a 10 foot spread is desired.

Cotoneaster damneri skogsholmen C. K. Schneider, the bearberry cotoneaster, is an evergreen groundhugging plant, widely used in other parts of this country and in Europe. It is occasionally available in Colorado and deserves more testing and experimenting with, especially since we have only a few vigorous broadleaf evergreen groundcovers suitable for this area.

Cotoneaster microphylla cochleata Wall. is a dwarf, extremely slow growing shrub for rock garden use or for small areas as a groundcover. The small leaved wintergreen shrub produces colorful fall color and red fruit that lasts well into the winter.

Cotoneaster divaricata Rehder and Wilson, spreading cotoneaster, is of a scale more suited for a residential site. It grows with gracefully arching branches to a height of 4 - 5 feet attaining a spread of 6 feet. In plantings of larger scale it serves well as a 4 foot high groundcover.

Cotoneaster integerrima Medic. Gesch. grows to about 6 feet height and 6 feet spread and is a graceful shrub for sunny locations. In fall it develops an interesting contrast between its gray-green foliage and its bright red fruit.

Cotoneaster apiculata Rehder and Wilson, cranberry cotoneaster, is

extremely suitable for groundcover planting of larger areas. It grows to a height of about 2 feet and achieves a spread of about 6 feet. The large red fruit resembles cranberries and is responsible for the common name. It hangs on long into the winter.

Cotoneaster congesta Baker, Pyrenees cotoneaster, attains about the same size and shape as *Cotoneaster apiculata*, the leaves however hang on longer in late

fall and make it a more wintergreen shrub. It appears to be less hardy than *Cotoneaster apiculata* though.

Cotoneaster horizontalis, Decne. Rock-spray cotoneaster, finds a great deal of use as a graceful shrub in rock gardens. It is rather susceptible to fireblight and should be used with caution. The similar *Cotoneaster apiculata* may be a better shrub to use.

Cotoneaster horizontalis Decne.



Cemetery To Conservatory

Part III

Cheesman Park *Redivivus*

Louisa Ward Arps

[Note: This is the third of a series of articles about the history of the land around the Denver Botanic Gardens. The first article, subtitled "City Cemetery" appeared in the Summer 1976 issue of *The Green Thumb*; the second, dealing with the beginnings of Cheesman Park, came out in the Autumn 1976 issue; the present article brings Cheesman Park up-to-date. Future articles will deal with the Roman Catholic and Jewish cemeteries, the pest house, the Morgan sub-division, the Capitol Hill reservoirs, the City Nursery, and Congress Park.]

In 1858, the Larimers, father and son, mounted their horses in the embryo Denver City to ride two miles east to claim land for a cemetery on a rise on the prairie which they named Prospect Hill. Since then the hill has changed from a graveyard, "treeless, shrubless, waterless, utterly forsaken and neglected except by prairie dogs,"¹ to green Cheesman Park, the Denver Botanic Gardens, and three reservoirs whose water has made possible the park and the gardens and the surrounding houses.

The prospect the Larimers saw was the great bow of the Front Range of the Rocky Mountains from Pikes Peak to Mt. Evans to Longs Peak and way beyond. Today, trees and high buildings have blotted out the north and south views. A small prospect is left, but that fortunately includes Mt. Evans; fortunately because Mt. Evans may be claimed as Denver's own, just as Colorado Springs claims Pikes Peak, and Longmont and towns to the north claim Longs Peak. Forty miles of highway connect Denver with the top of Mt. Evans, 40 miles from city traffic to alpine tundra, from a mile above the sea to 14,264 feet.

MOUNTAIN VIEW PRESERVATION ORDINANCE

Today's view of Mt. Evans, though limited, stands a good chance of being preserved for future users of Cheesman Park because of Denver City Ordinance No. 260, series of 1968. This is the Cheesman Park — Botanic Gardens Mountain View Preservation Ordinance, which specifies the allowable heights of buildings on the land sloping down from the flagpole east of the Botanic Gardens, west to Cherry Creek and Broadway, so that no future buildings will interfere with the view.²

The passage of this ordinance (and view preservation ordinances for four other locations³), was the result of seven years of patient work by concerned citizens and civil servants. The work started in 1960, when the Denver Planning Board appointed

the sub-committee on urban development, with Helen Millett Arndt and James B. Sudler as co-chairmen. The committee secured opinions from various citizens and then worked with the appropriate city agencies, especially the Denver Parks Department. One by one, each bill was presented, with public hearings, to the Denver City Council.

The arguments for and against were numerous and usually vehement. The stand of the sub-committee was contained in their statement that "the preservation of said views will strengthen and preserve the municipality's unique environmental heritage and attributes as a city of the plains at the foot of the mountains." The arguments against were based on the theory of economic inevitability — mountain views pay no taxes, but apartment houses do. Besides, it was too late — the views were almost gone and city smog smothered what was left. One councilman remarked that "if you have seen one mountain you have seen them all."

As each bill came up before council, these arguments were repeated, as is evident by the various readings and amendments it took to get the Cheesman Park — Botanic Gardens bill passed. The first reading of Council Bill No. 249 was on about July 1, 1968. Held in committee for three weeks, on July 22 it was amended and ordered printed, but when it came up for final reading on July 29 it was again amended and ordered printed. Finally, on August 6, 1968, Ordinance No. 260 was passed with six votes for, three against.⁴ It was printed August 9, 1968.

Apartment Building Obscures View



With this ordinance in force, one would surmise that the Cheesman Gardens, a tall brown and white apartment house at 1510 East 10th Avenue,⁵ standing squarely in the center of the area protected by the Mountain View Preservation Ordinance, must have been built prior to August 1968. This is not the case. This building started rising in September 1968, was up seven stories by January 1, 1969 (the allowable height under the ordinance), and continued rising, story after story, until it reached fourteen stories plus a penthouse in late 1970. During those busy months, the builders of the apartment house were seeking legal permission to build above the seventh floor from boards of appeal and courts of law.

The builders were Balmore F. Swan, president of the Empire Savings Building and Loan Association, and his contractor, Gerald H. Phipps. Their opponent was the City of Denver, as represented by the director of the building department, and the city attorney. Each side based its claim on a permit issued on July 22, 1968, by the building department, to B. F. Swan.

This permit recorded that B. F. Swan had paid \$3,150 for a permit to build a fourteen story luxury apartment house at 10th and Humboldt. This permit also stated that the permission to build was "for foundation only." These two statements seemed contradictory, Swan claiming that since he had paid the fee, he had a right to build a fourteen story building; the city claiming that the "for foundation only" clause meant that he had to secure permits for above ground building, which would be limited to seven stories because of the Mountain View Preservation Ordinance.

The case was tried first by the Board of Appeals of the Building Code, then by the District Court, and then by the Colorado Supreme Court, each side producing innumerable arguments. Swan-Phipps felt that the building would produce employment, that a luxury apartment house would improve the neighborhood, that the city coffers would be fattened by higher taxes, and that already money had been expended on land, demolition, architect's fees, et cetera, and that the delay was costing the builders money for which the city could be held responsible.

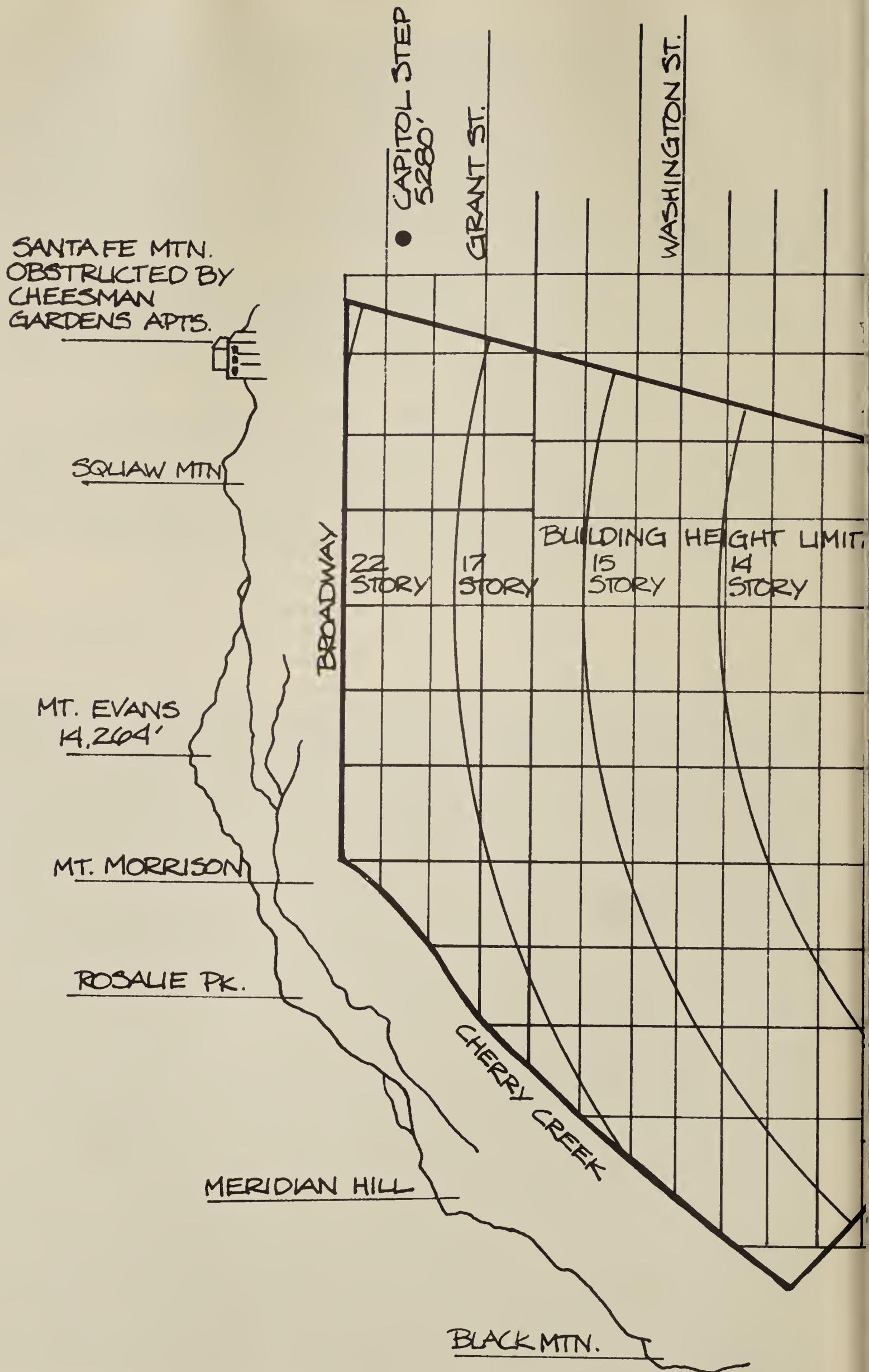
The city attorney argued that Swan-Phipps were running a race against the city ordinance, that Swan had bought the property with knowledge of the impending View Ordinance, that he had pushed through the permit with insufficient architectural plans, and that, right there, in black and white, the permit read "for foundation only."

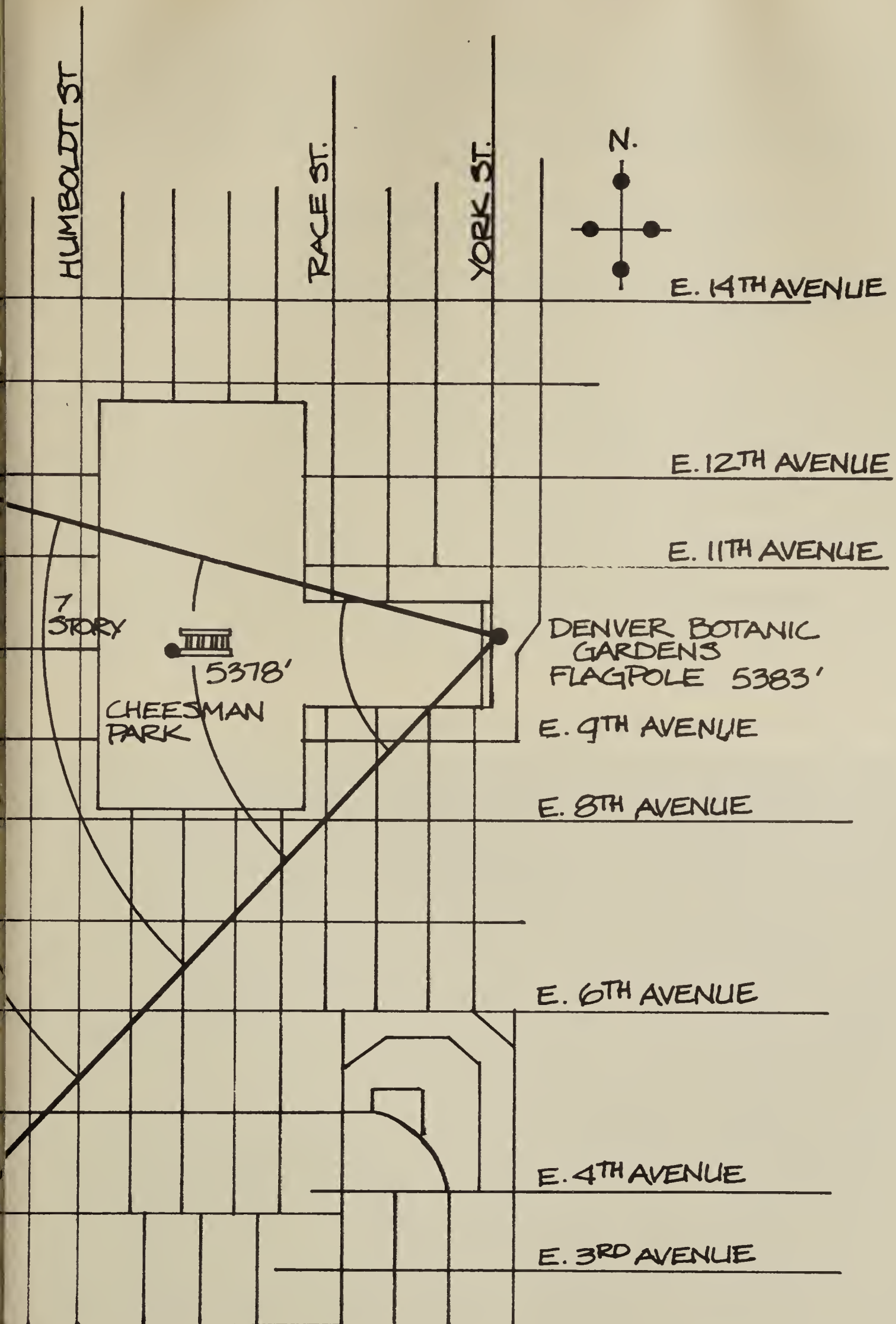
The Board of Appeals of the Building Code ruled that the permit was not "for foundation only." The city attorney took the matter to the Colorado Supreme Court, which court confirmed the decision of the Board of Appeals and denied a motion for retrial. The city attorney accepted defeat.

But the fight was continued by concerned citizens, five of whom petitioned the Colorado Supreme Court for a hearing.⁶ That court decided "on sufficient competent evidence" that the permit was not "for foundation only," and that the "Board of Appeals of the Building Code had before it, and rightly so, a building permit matter which arose out of the proper application of the Building Code and not out of the mountain view ordinance relating to height limitations." The Supreme Court decision was dated August 10, 1970,⁷ as the Cheesman Park apartment was nearing completion.

MOUNTAIN VIEW INDEX

A bronze plaque on a pedestal west of the Cheesman Memorial serves to remind today's viewers of what they could have seen before the era of tall trees and taller buildings. This plaque was installed in 1976 to replace the one which vandals had





defaced erected in March 1913⁸ by The Colorado Mountain Club. Financed by The Park People, the present plaque was cast from a wooden sculpture made by Lorn Wallace. It is a relief map of that part of the Front Range which curves in a semi-circle west of Denver, and includes mountains both seen and unseen from the Cheesman Memorial.

THE PARK PEOPLE REVIVE CHEESMAN PARK

The Park People,⁹ a private organization working closely with the tax-supported Denver Parks Department, are bringing not only the view-finder but the whole of Cheesman Park up-to-date. During the fall of 1970 they raised money to mend the roof, point up the stone and wash the marble of the Cheesman Memorial, ever recurring upkeep projects for which the city seldom had money. The Boettcher Foundation helped finance further improvements around the Memorial. The biggest decision was to eliminate the elaborate but crumbling concrete steps and balustrades. This concrete has demanded constant patching. In 1971 The Park People carted away the old concrete; the new, simple steps and green terraces have changed the look of the Cheesman Memorial from Victorian to classic, a decision taken with the approval of the Landmark Commission which seeks to preserve Denver's historic sites. Benches and trash containers made of massive concrete in simple and anti-vandalism design carry out the classic feeling. In 1971 the pools at the foot of the steps were repaired and a graceful spray of water reaches skyward from the center of the middle pool during the summer months.

Mt. Evans View Saved by Mountain View Preservation Ordinance



THE ROADS

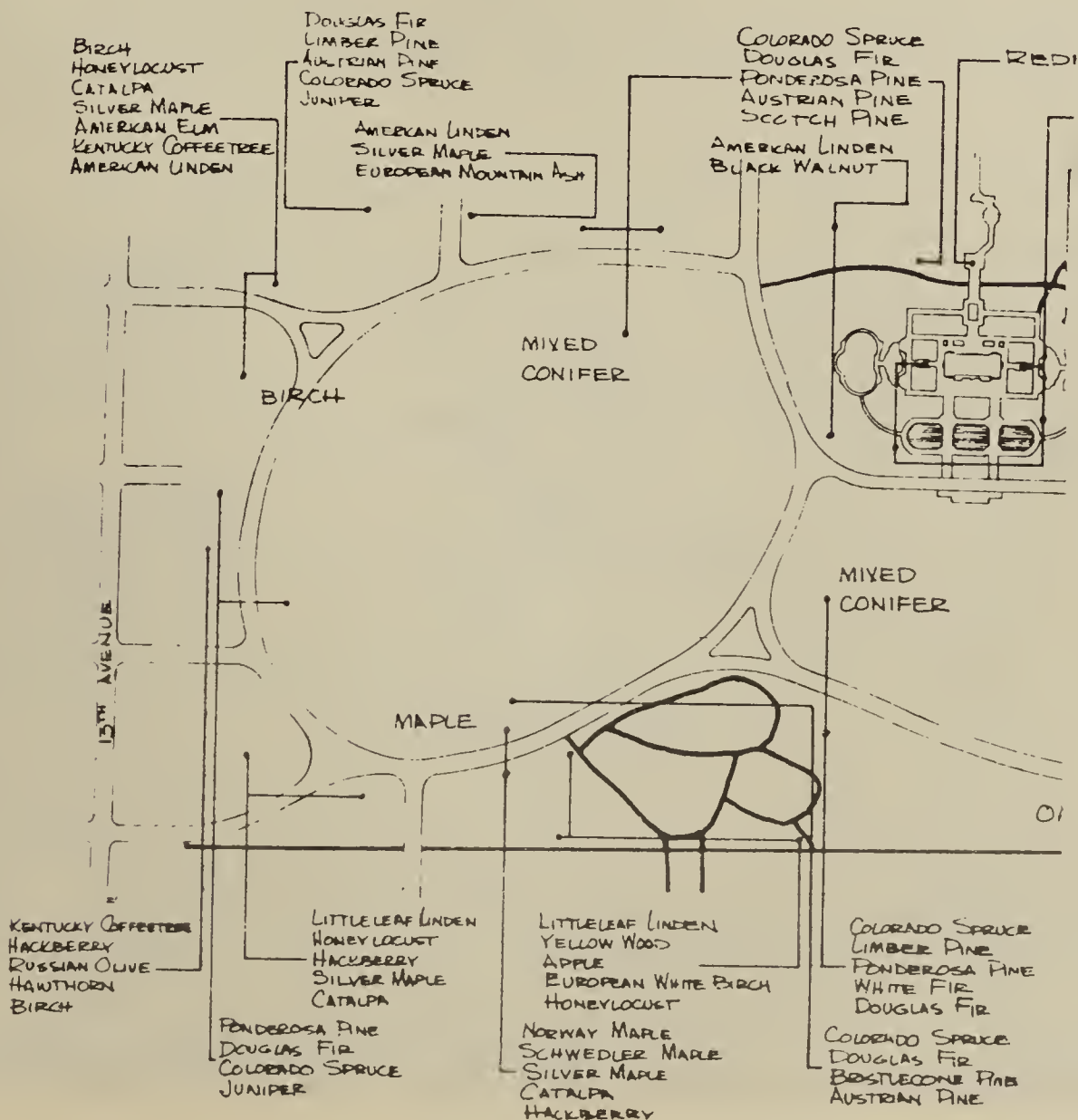
About 1912, when S. R. DeBoer became the city landscape architect, one of his first acts was to close off Franklin Street because of the increasing number of motor car drivers who zoomed down Franklin Street from Park Avenue and into Cheesman Park, alarming horses and pedestrians alike. Some 60 years later, some of the first acts of The Park People were to close the road east of the Memorial and to install stop signs on the western side of the park to curb speeding cars. Parking is allowed on most of the roads in the park, and a parking lot lies south of the Cheesman Memorial.

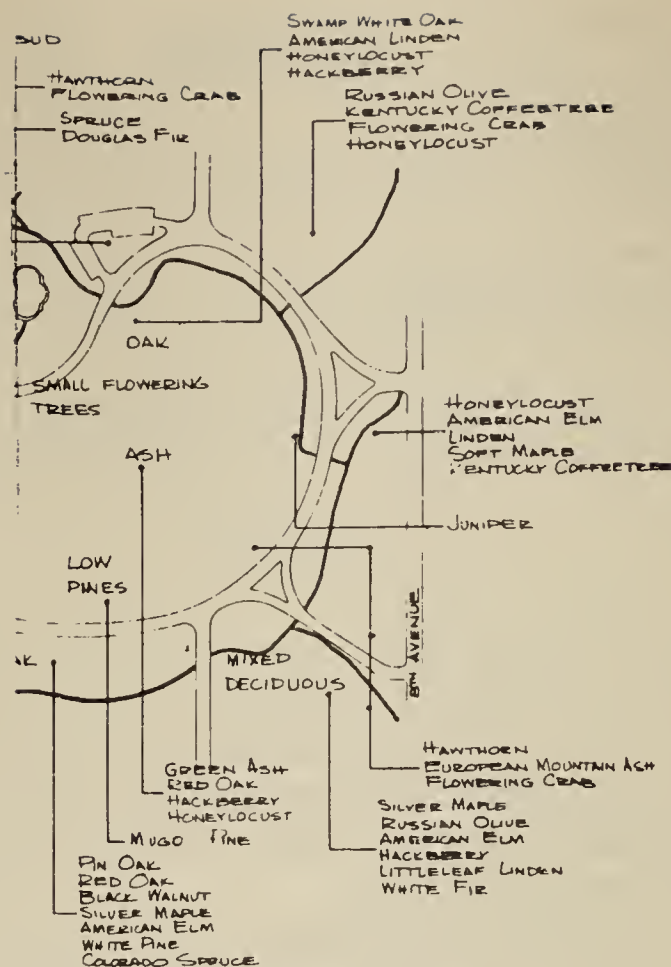
TREES

The interest in trees in Cheesman Park started when Reinhold Scheutze, the man who laid out the park, brought down evergreens from the mountains and deciduous trees from eastern nurseries, planting forty-eight varieties in all. That some of these still flourish today proves that native cottonwood trees are not the only trees suited to the Colorado climate (if watered). In fact, imported trees flourished so well that they are now encroaching on the mountain view.

Last year, The Park People published a chart showing the variety of trees now growing in Cheesman Park, including the Kentucky coffee trees, and the four rows of

Tree Plantings in Cheesman Park





Tree Plantings in Cheesman Park

lindens which mark where Franklin Street once cut through the park, which was to be Denver's *Unter der Linden Strasse*. To encourage gifts of trees as memorials, The Park People have erected a wall east of Cheesman Memorial to which plaques are attached to record special memorial gifts of trees, something like the list of public benefactors erected in the Civic Center when Mayor Speer encouraged Denver citizens to "give while you live."

Recently, The Park People completed a black-topped walkway around the park which might better be called a jogway. But the park needs few paths — the grass is there to be used. The absence of "Keep off the Grass" signs in Denver's parks reflects one of Denver's early and proud boasts — that the grass is to be used by the people.

And used it is! Any doubt of the worthwhileness of the renovation of Cheesman Park is dispelled by a look at the park, summer or winter, to see the number of people and dogs (preferably leashed) who enjoy it, from the playground on the west near the depression designed as a lily pond to the bicyclists and joggers on the paths and picnickers on the grass and wall-to-wall sun tanners and Nordic skiers and lovers and guitar strummers and softball players and Frisbee chasers and baby tenders and kite flyers and rose sniffers and mountain viewers who still enjoy a limited prospect from Prospect Hill, so named by the Larimers, father and son, in 1858.

REFERENCES AND NOTES

1. Smiley, Jerome, 1901, *History of Denver*, p. 900. Denver, The Times-Sun Pub. Co.
2. The ordinance stipulates that no structure within the area indicated by the triangular outline on the map "shall exceed an elevation of 5,393 feet plus one foot for each 100 feet that the structure is horizontally distant from the flagpole."
3. The other views protected by ordinances are from Cranmer Park, Ruby Hill, the Denver Museum of Natural History, and from the front step of the Colorado State Capitol Building where the 5,280 altitude marker proves Denver's claim to being called "the Mile High City."
4. Councilmen voting for Bill 249 were De Temple, Hentzell, Kelly, MacIntosh, Marranzino and Caldwell; those against were Burke, Hook and Keating.

5. The Cheesman Gardens apartment house replaces a gracious residence with Ionic pillars two-stories high designed in 1912 by architects Gove and Walsh for Leopold H. Guldman, owner of the Golden Eagle Department Store, at a reputed cost of \$50,000. In 1917, Frederick Bonfils, co-owner of The Denver Post, acquired the house; in 1950 his daughter, Helen, sold it to the Conservative Baptist Theological Seminary. Belmor F. Swan contracted in April 1968 to buy the house and six lots from the Baptists for \$221,000. By August 9, 1968 he stated that he had spent \$230,678 more for demolition and additional expenses.

Only three relics of the original house remain at 1510 East 10th Avenue: the leaded glass windows and the crystal chandelier in the entranceway to the apartment, and a few feet of balustrade leading to the garden on the south.

6. The five persons were Dana Crawford, promoter of Larimer Square, and four home owners on Race Street, Robert L. Stearns, Jean K. Bain, William B. Chenoweth, and Mildred Taylor, "all taxpayers living in the vicinity of Cheesman Park and interested in preserving the mountain view for themselves and all other residents of Denver."
7. Colorado Supreme Court, case no. 24424, Crawford vs. McLaughlin, decided August 10, 1970. (172 Colo. April, '70, p. 366ff.)
8. This is the correct date of the installation of the Colorado Mountain Club plaque, sometimes erroneously given as 1916.
9. The official title of The Park People is The Denver Parks and Recreation Foundation. It dates from 1969 when Joe Ciancio, manager of the City of Denver Parks and Recreation Department, interested a number of people in helping the city with its parks. The membership now numbers over 1200 with 40 directors. Its headquarters are at the Eugene Field Cottage in Washington Park. The foundation is financed totally by private and corporate donations, and works closely with the tax-supported Denver Parks Department on projects selected by the foundation's trustees. Its latest project is the restoration of the Four Mile House.

Cheesman Park Memorial and Fountain



Focus on

Cycas revoluta

in the

Boettcher Memorial Conservatory

Peg Hayward

Cycads are curious remnants of an ancient flora once plentiful in the vegetation of the world. Fossils from the Triassic period, 175 to 200 million years ago, testify to the antiquity of the group. Today only nine genera and fewer than 90 species survive, all in the tropics and subtropics.

Cycads, Cycadaceae family, are unlike their near relatives among the gymnosperms. To the non-botanist they have a remarkable resemblance to a tree fern or to a palm. The name *Cycas* was coined originally to indicate a similarity to the doum palm of Egypt and the Sudan. Cycads' glossy green leaves resemble the coarsely divided frond of a "feather palm." The trunk of the tree-sized cycad is rough where the dead leaves have broken away as is the case in so many palms. Both have starch stored in the fibrous pith in the upright trunks or the underground stems.

Some cycads develop a trunk 20 feet or more in height. Others show only their coarse leaves and reproductive

parts above ground while the heavy stem remains hidden in the soil. Those which develop obvious trunks have stout columnar stems, usually unbranched, to which the stubs of old leaf stalks remain attached. Leathery, fernlike leaves grow in a circle and form a beautiful spreading crown at the top of the trunk. New lush green leaves grow every year and remain on the plant for 1 to 3 years or longer, depending upon the species and the conditions.

Cycas roots are peculiar. In addition to a vertical tap root and weak branch roots, they develop masses of upward-growing roots near and at the ground surface.

The cones that bear seeds on a cycad are its most distinctive feature. No cycad produces both pollen and seeds on the same individual plant, so it has become common to speak of "male" cycads and of "females."

Two of the better known cycads are represented in the Boettcher Memorial Conservatory collection. *Cycas circinalis*

L., crozier cycas, is native to South India, and from Ceylon to the Philippines and New Guinea. It may reach a height of 15 feet. Its rough-surfaced trunk is topped with a rosette of stiff, glossy leaves up to 8 feet long. The male plant produces a vertical, oblong, orange colored odoriferous cone about 2 feet long. The female cone, up to 1 foot long, covered with rusty brown carpelary leaves, is broad and round-topped. The velvety, buff-colored sections open as seeds form.

Cycas revoluta Thunb., false sago palm, a native of China and Japan may grow to 10 feet high. Its numerous, crowded leaves are 2 to 3 feet long and recurved at the end. The fruit is densely

Cycas revoluta Thunb.

tomentose, but is not often seen in cultivated plants. Both of these varieties are commonly cultivated in conservatories. When grown out in the open in warm climates, their leaves are often cut and used in florists' decorations.

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Exotics of COLORADO

Musk Thistle

Carduus nutans

Helen Marsh Zeiner

Many weeds are exotic plants, often accidentally introduced. The musk thistle, *Carduus nutans* L., is such a weed. It is a plant of European origin which first appeared in the United States along the east coast where it is frequently found growing in ballast deposited at sea ports. From the coast it spread inward and is now common throughout the northeastern part of the United States. It has also become established in many other parts of the United States and in Canada.

Carduus nutans is a relative newcomer to Colorado. In 1954, Harrington stated in his *Manual of the Plants of Colorado* that *Carduus nutans* "has been reported in northeastern Arizona and may well be in Colorado." The plant apparently spread into the western part of Colorado from Arizona, and from there into northcentral Colorado. It is only within the last ten years that *Carduus nutans* has become a common weed to be seen in many places along



Carduus nutans L.

roadsides, in pastures, and on waste land. often in large patches. It may even appear as a weed in your Denver garden.

Musk thistle is a very beautiful large rose-purple thistle. At first glance, it resembles some of our common thistles belonging to the genus *Cirsium*, but there are some distinct differences. First, the pappus bristles on the receptacle are hairlike and scabrous, never plumose (feathery) as they are in *Cirsium*. Because of the nature of the pappus bristles, *Carduus nutans* is sometimes called bristle thistle or plumeless thistle. Second, and the most obvious difference to the casual observer, *Carduus* has broad, leaf-like spreading involucral bracts or phyllaries which are glabrous and sharp-pointed. The spiny leaves are excurrent on the stem, but this is also true of some other thistles.

Carduus nutans is a member of the family Compositae, and is one of the composites in which all the flowers of the head are disk flowers. *Carduus* is the ancient Latin name for this genus. *Nutans* is from a Latin root meaning nodding. *Carduus nutans* is sometimes called nodding thistle because the heads are solitary on the ends of long stalks and are somewhat nodding. Dr. W. A. Weber, in the fifth edition of *Rocky Mountain Flora*, calls musk thistle *Carduus nutans* ssp. *macrolepis* (Peters.) Kazmi. *Macrolepis* comes from two Greek words meaning large and scale, referring to the large involucral bracts.

Beautiful as this thistle is, it is well on the way to becoming a noxious pest. It is a biennial which spreads by seeds. Its parachute-topped seeds are produced in quantity and are easily carried by the wind, a most efficient means of seed dispersal. To control musk thistle, it must be prevented from going to seed. Cultivating out the first-year rosettes or mowing the stalks the second year are older means of control. The problem here is that many times *Carduus* grows where this cannot be done. The

chemical spray Roundup has been effective against thistles, but it kills other plants as well as the thistle. It is effective but not selective.

Biological controls may be the control of tomorrow. Dr. Wayland Lilly, head of the Plant Division of the Colorado Department of Agriculture, is planning some experimental tests using a weevil which eats the seed head of *Carduus nutans*. These insects will be released in May in carefully selected stands of *Carduus*, and the results will be observed and evaluated. This biological control has been used in Montana where it gave 60% control. The insect is selective for musk thistle, but will also feed on Canada thistle if it has no choice.

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Musk Thistle



COCKERELL of COLORADO

Last of the Victorian Naturalists

Joseph A. Schufle

To the English speaking world as a whole perhaps the name Cockerell brings to mind Sir Sydney Cockerell, the brilliant director of the Fitzwilliam Museum at Cambridge, the subject of Wilfrid Blunt's biography *Cockerell*. But to Coloradans the name Cockerell can mean but one man, Theodore Dru Allison Cockerell, Sydney's older brother, who moved to Colorado in 1887 and became what Bentley Glass called "the last survivor of that illustrious assemblage of naturalists of the Victorian era of which Charles Darwin was the most celebrated example."

That Cockerell was Victorian is revealed by almost everything he (and his brothers too, for that matter) ever wrote. Let us first admit that he was afflicted by that characteristic of many Victorians, stuffiness, also. But he was never dull. The picture of Cockerell in his office in Hale Science Building at the University of Colorado in Boulder, taken in 1945, a few years before his death in 1948, shows the distinguished naturalist in his happily cluttered sanctum sanctorum, surrounded by reprints of the more than 3900 articles and books which he published in his lifetime. Over it all hangs the dark and almost brooding portrait of Charles Darwin, whose ideas of evolution, along with those of Cockerell's friend and mentor, Alfred

Russell Wallace, were to dominate Cockerell's thinking throughout his lifetime.

Cockerell wrote his autobiography as a series of articles for *Bios*, entitled "Recollections of a Naturalist." Other biographical sources are given in the references.

Cockerell was born in Norwood, England, in 1866, the first of four sons born to Sydney John and Alice Cockerell. He had little formal education, partly because he was a sickly child. He remembered someone saying "be kind to the little boy, he will never grow up". In 1879 he was taken on a trip to the island of Madeira by a family friend, Henry Dru Drury, a descendant of the famous 18th century entomologist Drury. In Madeira he made his first scientific discovery, what was apparently the first identification of the caterpillar of *Pyrameis indica occidentalis*, a Madeiran butterfly, which he later reported in Lang's book of European butterflies. Thus he began his career as a collector and identifier of new biological species at the age of twelve, a career which he continued for seventy-two years until his death at the age of eighty-four. The University of Colorado bibliography of Cockerell's published works has 3,904 articles beginning in 1882 and ending in 1949. This

extraordinary productivity is an average of 58 published articles and books per year over a period of 67 years, more than one a week.

Joseph Ewan calls Cockerell's volume entitled *Zoology of Colorado* "his Climactic Work in Natural History". I am more partial to his *Zoology — A Textbook for Colleges and Universities*. For it is in this book that Cockerell includes his chapter on "The Red Sunflower", possibly the only chapter on plants in a zoology textbook in existence. But Cockerell gave a very good reason for this idiosyncrasy. "The red sunflower may be studied in illustration of the principles of heredity and of plant breeding. Its advantages for this purpose arise from the fact that its origin is known, and its whole history belongs to recent times, since the rediscovery of Mendel's Law." The origin of the red sunflower was known to Cockerell because he and his wife, Wilmatte Porter Cockerell, developed it in their garden in Boulder, Colorado.

Wilmatte Porter was the first chemistry and biology professor at New Mexico Highlands University after it was founded in 1898. Cockerell came there as professor of biology a year later and they were married in Las Vegas, New Mexico in 1900. Cockerell's son, Martin, by his first wife, Annie Fenn Cockerell, died of diphtheria in Las Vegas in 1902. The Cockerells moved to Colorado in 1904 and resided there until his death in 1948.

Cockerell first came to Colorado as a single young man in 1887 and lived in Westcliffe in Custer County. There he helped organize the Colorado Ornithological Association. Cockerell seemed to have a zeal for organizing such associations in those early days of our western United States. He was also one of the organizers of the New Mexico Academy of Science in 1902 during his Las Vegas period. Similarly he was active in the formation of the Southwestern and

Rocky Mountain Division of the American Association for Advancement of Science, and was one of the early presidents of the Division in 1926.

Cockerell returned to England in April, 1890, and was married to Annie Fenn on June 2, 1891. During this year in England he had one of the most important experiences in his life, his association with Alfred Russell Wallace. Wallace engaged him to edit the second edition of his book *Island Life*, so when Cockerell was not with Annie Fenn at the Fenn's house, he was working in the British Museum looking up material for Wallace's book. Cockerell admired Wallace immensely. And Wallace must have had high regard for Cockerell, since it was "doubtless Wallace who primarily recommended Cockerell to the post of curator of the Museum of the Institute of Jamaica."

Jamaican Discoveries

So Cockerell and his wife, Annie, set out for tropical Jamaica to make their first home after their marriage. Much of the story of their life there is preserved at the University of Colorado among the Cockerell papers in the form of about twenty pages of manuscript in Annie's handwriting. Theo, as Annie called him, kept busy with his work at the museum, and writing his research papers. Cockerell once wrote that he felt that he taught more successfully with his writing than he did in his classes. In 1890, he published 82 papers. In 1891 he slowed down a little, perhaps because of his marriage and his move to Jamaica, and published only 46 papers. But in 1892 he was back in stride and produced 88 papers. He continued at this unbelievable pace throughout most of his life.

The Cockerell's first child died shortly after birth. Both Annie and

Theo suffered attacks of "fever", malaria undoubtedly, and Theo's trouble with tuberculosis reappeared. But Cockerell kept working as hard as ever, classifying and describing the flora and fauna of Jamaica, producing for example *Additions to the Flora and Fauna of Jamaica* and *New Varieties of American Mollusca*.

Before Theo left England he had become a member of the Socialist League. In Blunt's biography of Theo's brother, Sir Sidney Cockerell, he states:

"On 15th November 1885 Theo and Sydney went to their first Socialist meeting at Kelmscott House, Hammersmith. William Morris was announced to read a paper on Socialism, but it was read in his absence by his younger daughter, May. Theo at once declared his adherence, and a fortnight later was elected to the Hammersmith Branch of the Socialist League."

At first Theo was the Cockerell closest to Morris, and Sydney was "Theo's brother". But after Theo left

England, Sydney and Morris became most intimate friends. Morris remained an influence on Theo also, but in far-away America this influence died away in time.

Theo had obviously experienced some hard times with the English economic system for he stated a wish for the time when commercialism would be destroyed. In Jamaica he was already something of an authority on several kinds of insects, with nearly 500 publications to his credit by the end of 1891. But his education was not gained at the university, and if we consider the clanish nature of the English university society, it is very possible that Theo was forced to go into the comparative solitude of Jamaica by the fact that he may not have been accepted as a fully accredited scholar by the scientific community in London. Alfred Russell Wallace may have suggested the move to Jamaica to Cockerell on the basis that he would be more readily accepted at face value in the New World, as he indeed was. Cockerell was sensitive to

T. D. A. Cockerell Surrounded by his Writings



his lack of formal education, but he remained critical of the university educational system to the end.

Work in New Mexico

After two years in Jamaica Theo came into correspondence with Professor C. T. H. Townsend of New Mexico State University in Las Cruces (then New Mexico Agricultural College), and they agreed to exchange positions. So Theo and Annie left Jamaica by sea for Vera Cruz, and travelled through Mexico by rail to Las Cruces. He describes their trip:

"Passing through a country new to me, I was keen to find *coccidae*, though the opportunities were few. As the train stopped at a station near the foot of Mount Orizaba, I jumped out and hastily examined the leaves of some of the trees along the platform. In this way I obtained the new *Chrysomphalus scutiformis*, now known to infest citrus. . ."

Theo later reported on "Some Mexican Coccidae" in 1893, doubtless using specimens collected in this breathless manner.

Cockerell's work in Colorado is the work upon which his reputation principally rests. He did work on fish scales of sufficient importance to justify a large paper, "Observations on Fish Scales", published by the U.S. Bureau of Fisheries, Vol. XXXII, 1912. His work on bees was published in 168 parts in a series in the *Annals and Magazine of Natural History*, published in London. This was in addition to *Bees of New Mexico* (1906), and many other similar publications. He stated that he had published 5840 new names for species of bees, and 146 names for genera. But perhaps for botanists the work that he and Wilmatte Porter Cockerell, his second wife, did on the red sunflower will be of most interest. He tells the

story in his autobiography, of which I will quote some of the more interesting segments.

"In the summer of 1910, at Boulder, Colorado, my wife discovered a red sunflower growing by the roadside close to our house. It was a wild plant, one of a group of prairie sunflowers, *Helianthus annuus lenticularis* . . . This form has comparatively small heads, bright orange rays, and nearly black discs. . .

"Little as we know about the origin of such mutations, it is a fact that mutations do occur here and there among wild and cultivated plants, and that these altered forms may be utilized in the production or introduction of novelties which may be of great value. . . I will give some account of our personal experience which may be helpful to those interested in floriculture. . .

"In the first place, no elaborate technique is required, nor is it necessary to have a large plot of ground, at least in the early stages of the work. . .

"The pigment which gives the red color is really a wine red, as may be seen when it is extracted in a test-tube. We crossed a white variety of sunflower with the chestnut reds, obtaining chestnuts reds in the first generation, but in the second the four forms expected according to Mendel's law, in the proportion 9, 3, 3, 1 — nine chestnut reds, three orange (like the wild form), one pale yellow (like one of the grandparents), and three of the new type, red on pale yellow. As was anticipated, this last gave a new color, a sort of "old rose" or claret, in the best forms exceedingly rich and beautiful . . .

"It has often been remarked that certain famous American authors found their first opportunities for fame and success abroad rather than at home. In the case of the red sunflower we were very fortunate in establishing relations with Sutton and Sons, of Reading, England, who

introduced the "New Red Sunflower" with a full page colored plate in their catalogue, and gave us a very good price for the seed. The first payment on the sunflower seed was used to purchase a picture showing the interior of Westminster Abbey, by Rooke, one of the most distinguished water color artists of our generation. It hangs in the library of the University of Colorado...

"Eventually, in 1913, Peter Henderson and Company (New York) took over the red sunflower for introduction in America, and issued full page colored plates, showing the different varieties, in their catalogues for 1914, 1915, and 1916. My wife contributed an article "The Making of the Red Sunflower" to the *Garden Magazine*, July, 1914 ... Still later (1915) Burpee advertised the sunflower widely ..."

In their later years, the Cockerells began to spend more time in the California islands of the Santa Catalina neighborhood.

"I found myself concentrating more and more on the study of wild bees... and the natural history of the eight islands off the coast of Southern California; Santa Catalina, San Clemente, Santa Barbara, San Nicolas, forming the southern group; and Anacapa, Santa Cruz, Santa Rosa, and San Miguel, the northern group... In the beginning, I was resolved to pay attention only to the terrestrial flora and fauna, but as the work went on, it was necessary to learn as much as possible about the geology of the islands, and impossible to ignore the surrounding seas, with all their problems of ocean currents and temperatures, and all the abounding life of the ocean..."

"When I settled down to this undertaking in 1937, it was discouraging to find that the islands were, in general, very difficult of access. Any one could go to

Santa Catalina to be sure, but to reach the others appeared to be almost impossible, and in any case very expensive. My first real chance came in July, 1937. I was living in Santa Barbara, and read in the paper that a group of senior Boy Scouts was going to San Miguel Island. I called their leader, Mr. J. H. Leecing, and was very generously invited to go along as their guest. We camped near the shore and had a most interesting time. (See *Scientific Monthly*, February 1938, for particulars.) I obtained no less than twelve new kinds of bees, and many other specimens of interest."

And so we leave this marvelous example of what is best in mankind, T. D. A. Cockerell, a man of insatiable curiosity ending his life as he began it, collecting nature's wonders and describing them for the rest of us to share in his enjoyment. I have to agree with him that he teaches as well with his writing as he ever did in his classes. For here I am, 30 years after his death, pouring over the fabulous wealth of written materials that he has bequeathed to us, and marveling at the breadth of his mind. I can only conclude that here was one of our greatest teachers, who nevertheless knew that he would never understand all of the wonderful world around us. For he wrote in his poem, "The Last Lecture":

"Can we know all? Nay, but the
major part

Of all that is must still elude our
grasp.

For life transcends itself, and
slowly noting what it is,
Gathers fragments from the stream
of time.

Thus what we teach is only partly
true.

Not knowing all, we act as if we
knew,

Compelled to act or die."

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Looks At Books

Weber, William A. 1976. *Rocky Mountain Flora*, Fifth Edition, Revised. Colorado Associated University Press, Boulder, Colorado. \$12.50

All those interested in the identification of the native plants of the Front Range area of Colorado are acquainted with the invaluable contributions made to this subject by Dr. Weber over a period of 25 years. From the publication in 1953 of his first volume *Handbook of Plants of The Colorado Front Range*, Dr. Weber's intensive and unceasing investigations of the plants of this part of Colorado have resulted in a series of

revisions of which this is the latest and undoubtedly the most comprehensive and most valuable to students of our native flora. The significance of this statement is evidenced by the observation that *Handbook of Plants* was a book of 238 pages, while the 1976 edition of *Rocky Mountain Flora* has grown to 489 pages. The number of species treated in this latest edition is over 1600, representing over one-half of the total number known to occur in the state of Colorado. This statement illustrates the richness of the flora of the Front Range which is covered in this book.

Much more than mere enlargement is represented in this new volume. Expan-

sion of the keys to include more characters applicable to identification of plants in the field, wider use of ecological observations, and addition of interesting notes on each of the plant families treated have been included.

In addition to the illustrations done in the earlier editions by Dr. Charles F. Yocum of Humboldt State College, Arcata, California, the author has included new line drawings by Ann Pappageorge of Loveland, Colorado. Handsome color plates are reproductions of the photographs of the late Harold W. Roberts of Denver, and of the author, and the number has been doubled in this edition over that in the previous publication.

In the new Preface to the Fifth Edition Dr. Weber warns about the serious damage which has been inflicted upon the native flora by increasing urbanization and development of large areas of the Front Range for man's purposes. In the same section, but in quite a different vein of thought, Dr. Weber points out the relationships of our flora with that of the American Arctic and Eastern Asia resulting from the migration route for plants from those areas offered by the Rocky Mountain Chain. Because many of our species are very closely related or identical to those in the mountainous portions of Eurasia, the author states that "Unfortunately for us, some of our plants will have to be called by the names in use in Eurasia, since they have priority, and because more intensive research is going on in Eurasia on the mountain floras than here in the United States." Careful users of Dr. Weber's book will understand why some of the names they have used for certain plants for a long time may have been changed in this edition.

A new section at the beginning of the book discusses the subject of threatened and endangered species. In this edition Dr. Weber has drawn attention to those species which he considers to be threatened or endangered in Colorado.

In summary, the new Fifth Edition, Revised, is the first full-scale revision of the book since 1953. Retained in this edition is the compact size (8" x 5¼") and the plasticized cover which make it so convenient for use in the field. Sections on plant zones, plant geography, instructions on the use of the keys and on making a plant collection, a discussion on the naming of plants, an excellent glossary (partially illustrated), a list of the most useful references on the Rocky Mountain Flora, the arrangement of the families of dicots and monocots in alphabetical order, and highly usable keys are combined in this book to make it a most useful volume in the field and in the laboratory for serious students of the flora of Colorado's Front Range region.

William G. Gambill, Jr.



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THE COVER

Signs of Autumn

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Editors

FALL, 1977

Fund Campaign for Progress	66
Cemetery to Conservatory, Part IV <i>Louisa Ward Arps</i>	68
Small Fruits in High Altitude Gardens <i>W. B. Pings</i>	75
Roadside Gardens <i>Joanne S. Dur</i>	83
Francis Ramaley, Mountain Botanist <i>David Ramaley</i>	86
Garden Meditations BEP	92
Focus on <i>Caryota</i> <i>Peg Hayward</i>	93
Exotics of Colorado — Mullein <i>Helen Marsh Zeiner</i>	95
Looks at Books <i>Moras L. Shubert, Solange Gignac</i>	97
In Memoriam, Margaret Eppich Honnen, Dr. Robert L. Stearns	99, 100

Fund Campaign For Progress

John C. Mitchell, president of the Board of Trustees of the Denver Botanic Gardens Foundation, announced recently that the Trustees of the Foundation are launching a capital campaign to expand the current Garden complex.

The campaign, which will be launched shortly, will seek a minimum of \$1,500,000. Funds for the project will be used for several different areas of the Gardens. Among them are: completion of the Rock-Alpine and Japanese Gardens; the building of an orchid and bromeliad display greenhouse; expansion of the children's, family, and handicapped peoples' gardens; planning, designing and planting of an arboretum to be located near Denver at Chatfield Recreation Complex, establishment of a maintenance endowment fund, building of a mini park at York Street with outside picnic facilities, and the drilling of a deep water well at York Street to ensure a continuous water supply for the Gardens.

The current effort will mark the first capital campaign since 1969, Mr. Mitchell said.

Founded in 1957, the Gardens were first located on a one hundred acre site adjacent to the Museum of Natural History. Later, in 1958, the Gardens moved to the present location at 1005 York Street.

During that same year a 160 acre alpine and subalpine unit was established on Mount Goliath about 50 miles from Denver. Operated jointly with the U.S. Forest Service, the Mount Goliath unit is the subject of many guided field trips each year.

In 1958, a trustee of the Gardens purchased the house at 909 York Street and donated it to the Gardens as an administrative headquarters.

In 1960, the Boettcher Conservatory was built to house tropical plants. Over 600 tropical plants are now in the Conservatory. Later, in 1969 with the help of the Boettcher Foundation the education building was attached to the Conservatory to round out the facility.

A research and education site of the Gardens has been established in the Montane Zone near Evergreen, which will eventually be a montane zone of the Gardens. A montane zone is the moist cool upland slopes of a mountain below timberline.

The York Street garden complex has over 7300 different kinds of plants and 30,000 individual specimens. In addition, there are approximately 70,000 annuals grown from seed for floral displays and testings each year. In addition to the Boettcher Memorial Center, which houses the Conservatory and education building, are four greenhouses and a headhouse.

Mr. Mitchell said that the Gardens has a membership of 3400, an increase of 200% over the last decade. He also stated that over 600 people give their time and energy to the Gardens annually.

Serving with Mr. Mitchell on the Board of Trustees of the Gardens are: Mr. J. F. Baxter; Mrs. John Brooks, Jr.; Mrs. Donald C. Campbell; Mr. Joe Ciano, Jr.; Mr. Edward P. Connors; Dr. John R. Durrance; Mrs. John F. Falkenberg; Mrs. Frank B. Freyer, II; Mrs. George H. Garrey; Mrs. Jess Gibson; Mr. Newell M. Grant; Mr. O. Ben Haley, Jr.; Mrs. Richard W. Hanselman; Mr. Richard A. Kirk; Mrs. Robert M. Kosanke; Mr. Harry B. Kuesel; Mr. Lawrence A. Long; Mr. William J. Lunsford; Mrs. Willett S. Moore; Mrs. Graham B. Morrison; Mr. Charles C. Nicola; Mrs. Norman F. Patrick; Dr. Moras L. Shubert; Mr. William R. Thurston; Mrs. James J. Waring; Mrs. Theodore B. Washburne; Mr. Kenneth G. Wilmore. Ex-Officio Trustees are: Dr. Kenneth Brink; Mr. Herbert I. Jones; Mr. William H. Kistler; Mayor William H. McNichols, Jr.; Mr. Allan R. Phipps; Mrs. Walter G. Ruesch. Ex-Officio Members Representing Organizations are: Mrs. Herbert G. Franson; Mrs. Herbert Glick; Mrs. Harley G. Higbie, Jr.; Mrs. Harry Wadsworth. The Life Trustee is Mr. Hudson Moore, Jr.

Campaign Leaders



William J. Lunsford — Richard A. Kirk — John C. Mitchell

From Cemetery to Conservator

Part IV — Calvary Cemetery

Louisa Ward Arps

[Note. This is the fourth of a series of articles published in *The Green Thumb* telling the history of the land around the Denver Botanic Gardens. Future articles will deal with the Jewish Cemetery, the Pest House, the Capitol Hill Reservoirs, the City Nursery and Victory Gardens, and present Congress Park. Refresh your memory by referring to the map of the area in the Summer, 1976 issue of *The Green Thumb* page 37.]

Colorado was still part of Kansas on February 27, 1860, when the Kansas Territorial Assembly granted permission to William Larimer, Jr. and William Clancy to incorporate the Mount Prospect Cemetery Association to purchase land to be used as a burial ground. Nothing in this document indicates that parts to be used by the Roman Catholics and the Jews were to be segregated, but the partner named Clancy — he of the Irish name — could have insisted on this. That he had the church interests at heart is proved by the fact that soon after he came to Denver in November 1859, he persuaded the Denver Town Company, of which he was a director, to offer the Roman Catholics some lots on which to build their church.

"William Clancy was one of the early birds who had a street named for him, then flew away," commented a pioneer. "The street has since been re-named (and is now Tremont), but in '59 and '60, Clancy lined up as one of the front row of promoters and 'boomers'. He was a lawyer by profession and whether sober or otherwise was quite prominent in public affairs. He was as worthy as some other pioneers of having his name . . . perpetuated on one of Denver's Streets."¹

If it wasn't Clancy perhaps it was Larimer's next partner in the burial business, an astute business man named John J. Walley, who saw the advantage of setting aside acres for Catholic burials. Walley claimed that he became an undertaker by accident.

As he stood on a Denver street in 1859, Jim Gardner shot a man for refusing to drink with him. Walley, a carpenter, was instructed to measure the corpse and make a coffin. While he was at work on this project, a lynching party did away with Gardner, so Walley made another coffin and buried them both, probably at Mount Prospect.²

On December, 18, 1861, the *Rocky Mountain News* announced that Walley was now associated with General Larimer and they hoped to beautify their "city of the dead." Two years later the paper complained that the cemetery was a shame and a disgrace — at least it could be fenced to keep stock from roaming at will.³ Since later the Roman Catholic church claimed they had been using a distinct part since 1863 perhaps this is when the separation was made.

When Larimer left Denver in 1864, Walley appointed himself Larimer's heir to the graveyard, but Larimer's son averred that Walley had acquired the land through chicanery. On April 22, 1864, Walley filed on the 160 acre plot and received a certificate of pre-emption.

The *Rocky Mountain News* claimed that 67 people had been laid to eternal rest in the Roman Catholic part of Mount Prospect by May 16, 1866. Of these 67, the names of only six are recorded in the Calvary Cemetery records kept by Mt. Olivet Cemetery. They are:

1864, July 10 — the child of James Clifford

1865 — James O'Haire, 3 years old, and James O'Haire, 28 years old, buried on the same day.

1865 — F. J. Smith, 4 years old.

1866 — Ellen Howlett, 22 years old.

1866, July 10 — James Clifford, 28 years old.

Ten burials were recorded in 1867, and more every year until 1909.⁴

"Mrs. Henrietta Dieterman, 36 years old, and son, John, 5 years. These two killed by Indians," reads one of interest dated August 25, 1868. The mother and son had been killed by Indians on Comanche Creek (near present Strasburg) in the last Indian uprising ever to threaten Denver. Frank Hall, who was acting governor of Colorado Territory at the time, wrote that "a wagon was driven into the city bearing the mutilated remains . . . The boy had been shot several times and his neck broken. The mother had been shot through the body, her person violated, stabbed and scalped. This was one of the most horrible spectacles I ever witnessed. The remains were exhibited to the public, exciting fierce indignation."⁵

As intended, the horrible sight inspired volunteers to arm themselves and chase the Indians south to the Arkansas River. Volunteers had to be incited because regular army troops were unavailable. One general, when asked to help, telegraphed Hall, "I already have my hands full."

About 90 years later, the Dietermans' corpses were on exhibit again, though unofficially. A workman digging up coffins to be transferred to Mt. Olivet, asked one of the neighbors if she wanted to see something amazing but not pleasant. She did, so he opened the coffin to reveal the uncorrupted bodies of mother and child, which disintegrated as they watched.

CONGRESS RECLAIMS LAND

John J. Walley's undertaking business on the hill two miles east of Denver City ended abruptly on March 17, 1870, when the U.S. Congress annulled his rights to the

land. Walley did not care much, he later said, because he thought the land would never be valuable. The next month, the mayor of Denver, Baxter Stiles, called the attention of the city council to the fact that the city had no title to the cemetery land since Walley, from whom the city had purchased it, had no title. (This is the only record that Walley had collected money from the city. If so, one wonders how much?)

And if so, the city had to buy the land all over again, this time from the United States. On October 30, 1872, Joseph E. Bates, mayor, paid \$1.25 an acre for 160 acres of land to be used for burial purposes in perpetuity. On February 7, 1874, the city made no profit when it sold 40 acres of this land to Bishop Machebeuf of the Roman



This picture of Prudence Bostwick, who still lives just north of the Denver Botanic Gardens, was taken in the Calvary Cemetery about 1912. Note that the grass, the bushes, and the trees were flourishing, and the tombstones were still erect.

Catholic Church for \$50.00, or \$1.25 an acre. (Was it Bishop Machebeuf who at this time christened the burial ground Calvary Cemetery, often written as Mount Calvary Cemetery?) Most of the burials were on the northern 20 acres of the land. As soon as water was available from the first of the Capitol Hill reservoirs, in 1888, the place was improved with green lawn, bushes, and trees.

Fifteen years after Bishop Machebeuf bought the land, his body was buried there. On July 1, 1889, all the ritual of the Catholic church surrounded the interment of the beloved bishop. On April 10, 1899, another long procession, impressive with military bands and dignitaries of city and state, had followed the hearse of a man who had been lieutenant-governor of Colorado, U.S. Senator, millionaire, public benefactor, bankrupt millionaire, and postmaster — H. A. W. Tabor. After the ceremony his wife,

blonde and beautiful Baby Doe asked to be left alone beside his grave and the grave of her one-day old son, her only son, who had died in 1888. She stayed there until the April sun set behind the Rocky Mountains which are "at seven on an April night immeasurably high." ⁶

Baby Doe outlived Tabor by 36 years. After her death, his body was taken to Mt. Olivet to lie beside hers. The dis-interment was attended by priests, nuns, a black hearse, and a derrick to lift the heavy coffin. (The body of Tabor's first wife, Augusta, lies at Riverside Cemetery.)

MORGAN'S SUBDIVISION

Two years before his death, Bishop Machebeuf had sold the southern half of the 40 acres of Calvary Cemetery to a real estate man, Samuel P. Morgan, for \$20,000. If any proof is needed that Denver's residential district was growing east from Capitol Hill it lies in the increase of land value: February 7, 1874 — \$1.25 an acre; April 25, 1887 — \$1,000 an acre.

S. P. Morgan was from Hartford, Connecticut, and had spent ten years on the sea as a whaler before coming to Blackhawk, Colorado Territory, in 1872. He ran a smelter there, then made money in Leadville mines and later, as a canny real estate man in Denver.⁷ Morgan felt he had a \$20,000 bargain, and the bishop was pleased with the money, but the officials of Denver were not pleased. They questioned the right of the Catholic church to sell land that had been sold to them for burial purposes. They took the church and/or S. P. Morgan to court — court after court. In 1903, when Morgan had been in his grave for 5 years, the U.S. Supreme Court upheld his title.⁸

The helpless anger of the officials of Denver at this decision is reflected in an amendment to the city charter of March 29, 1904, which reads that "no portion of Congress Park, or any other park now belonging to the city, shall be sold or leased at any time." This holds today; if the city wants to sell park land (for highways, for instance) it must get a vote from the people.

After the panic of 1893, houses rose north of the cemetery; in the early 1900s, fine homes appeared on Humboldt Street west of the incipient Congress Park; but it was not until 1910 that the first house was built in the Morgan Subdivision. Today, individually designed homes stand from 9th to 8th Avenues, from Race to York.

COMPLAINTS

Whenever the newspapers of Denver lacked sensational news, one of the editors would send a reporter out to the cemetery on the hill. From as early as 1863 when cattle roamed at will among the graves, such items appeared spasmodically in the press, the accounts in the 1890s dwelling ghoulishly on the City Cemetery. On June 22, 1903, Calvary Cemetery had its turn when the *Denver Times* complained about the manner in which paupers were buried "in the wide expanse of prairie land" between Calvary Cemetery and the Hebrew burial ground (east of present York Street). This pauper plot was fenced, and Charles Cox, who lived at 1064 Gaylord and spoke for all the neighbors, told of looking over the fence to see how paupers were buried. (The nominal charge was \$2.00.) Cox saw "the rotten remains" of previous burials dug up, sometimes two from the same grave. These were left for hours just south of the dining room window of one of the neighboring houses. The undertaker's reason for this

technique was twofold — it is easier to dig previously disturbed ground, and the new coffin would lie straight on the bottom with the old ones piled on top.

On June 23, 1903, the day after this news story, the *Times* reported that the Health Officer would try to stop this practice, though one of the councilmen said the publicity was just another ploy by real estate dealers to run the cemeteries out of town. On June 24th, the *Times* editor had praise for some portions of the cemeteries. "If burials cease and the cemeteries are kept as well as the Jewish and principal portions of the Roman Catholic," he thought all would be well. "The Jewish cemetery is perhaps the most beautiful spot in the city, and the Catholic not far behind, except for the burial of the very poor."

The City officials, who had been trying to make the Catholics stop using Calvary since 1890, were still unable to stop the burials in 1903. Not until 1908 did the Catholics finally agree to desist, though the records show two burials in 1909, one in March, one in June.

ABANDONED

Ever since Mt. Olivet was opened in 1890, bodies from Calvary had been transferred to the new cemetery, and in 1913 many were transferred, one account saying "thousands." The fence that once surrounded the sacred ground was broken and children could short-cut across the plots. Even without water, for years the lilacs and snowballs and iris would bloom for the children to take home to their mothers, and gradually the prairie flowers returned — the sand lilies and yucca and cactus. As late as 1931 the two Kerr boys built an elaborate two-story tree house in one of the huge cottonwoods that graced the northwest corner of the cemetery. For their own uses, the children gathered bones, and hinges or handles or locks from coffins, and even, with great effort, took home some of the smaller headstones. The larger ones *in situ* made splendid hobby horses or vaulting blocks. One of the grown-up neighbors had a succession of dogs which she buried in her own garden, but used small pieces of marble from the cemetery to mark their graves. On summer evenings, picnickers grilled steaks on pieces of iron fences that once surrounded family plots, laid between two tombstones. A 32-year old man lived for two months in a sunken grave. In 1936, the *Rocky Mountain News* declared the neglect disgraceful.

Everyone gave the Catholics advice about how to use the land, a property doubly valuable because of the view of downtown Denver backdropped by the Rocky Mountains. Rotary International appreciated the site so much that it paid a \$5000 down payment to Bishop Tihen on January 16, 1946, after which the organization decided to build its headquarters elsewhere, much to the disappointment of A. B. Trott, president of Daniels and Fishers store, whose idea it was. At that time the land was valued at \$135,000.

THE CITY BUYS THE CEMETERY

In 1950, some 40 years after the burials had stopped, the Roman Catholic Diocese sold the 18 acres⁹ still remaining of Calvary Cemetery to the city of Denver for \$80,000, with the agreement that the city would remove an estimated 6000 bodies. This work took months, all under the watchful supervision of neighbors, young and old.

Plenty of relics still remained, and the city-owned 18 acres was more full of holes than ever. The city trucks dumped autumn leaves gathered from the streets on the property, creating booby traps for walkers. Later, when the Wright McLaughlin Engineers bulldozed the land horizontally, their machines sometimes partially fell into leaf-filled holes.

The city withstood bombardments from developers to sell the land, but high apartment buildings rose around the area, blotting out the view of Pikes Peak to the south, of Longs Peak to the north, leaving only Mount Evans visible to the west over Cheesman Park. In 1956, a religious organization (Protestant) wanted to build a home for old people, an idea squelched by some of the home owners in the Morgan Subdivision.¹⁰

A happy solution to the problem of how to use the old cemetery grounds was spearheaded in 1958 when Dr. and Mrs. James Waring bought the house at 909 York Street and gave it as headquarters to the Denver Botanic Gardens Foundation. Obviously, the 18 acres to the north should be used as gardens. Today, the city still owns the old Calvary Cemetery ground, the Department of Parks maintains the gardens, and the Denver Botanic Gardens Foundation, with its many contributors who have financed plantings, fountains, pools, an educational building, and a conservatory, has turned Calvary Cemetery into a beauty spot, a 90 years' journey from cemetery to conservatory.¹¹



The Last of the Cemetery Disappears

References

As is all Denver history, this article is based on books by Smiley, Hall and Vickers, and the index cards at the Denver Public Library Western History Department. David F. Halaas looked up records of early Denver cemeteries when he wrote *Fairmount and Historic Colorado* (1976 Denver: The Fairmount Cemetery Association). Many people who grew up near Calvary Cemetery furnished entertaining tales, but Miss Prudence Bostwick was the only one who furnished a photograph.

1. *The Trail*, v. 1, no. 11, p. 17-18. What little else is known about Clancy comes from Smiley's *History of Denver*. He arrived here in November 1859 and joined Larimer's Denver Town Company as a director. Dues were \$1.50. With D. C. Collier he built a cabin on the north side of Larimer Street near Cherry Creek. He was in favor of forming a territory immediately, and he was appointed a committee of one to try to bribe William Byers to move his newspaper office from Auraria to Denver. He went to Butte, Montana, which did not start until 1864. Clancy's name is in neither the 1866 Denver directory nor the 1871.
2. Interview with John J. Walley in *Sharp Scrapbook*, v. 8, p. 46, and v. 9, p. 59, and his obituary in the *Rocky Mountain News*, January 5, 1920. Walley came from Albany, New York, to Auraria in 1859. He got lumber for his carpentry business from his sawmill near Palmer Lake, and he ran his combination furniture and undertaking establishment at 1409 Larimer Street. One of his employees, August Renouard, discovered an embalming method that enabled bodies to be shipped back to the States. When Walley was 90 years old, the oldest undertaker in the U.S.A., he was proud that he had avoided the services of his fellow craftsmen for so many years. He died at his niece's home at 1457 Washington Street, Denver, aged 94.
3. The cemetery was still unfenced in 1866 when Bayard Taylor came down the Cherry Creek road and wrote "Our next sign of life was the evidence of death — the unfenced cemetery of Denver at the top of the ridge." (In his *Colorado, a Summer Trip*. 1871. New York: Putnam.)
4. Neither Larimer nor Walley kept records — at least none has been found — and the official burial lists of the Catholic church in Denver start in 1870. However, Mt. Olivet Cemetery, at West 44th and Ward Road, kept a few records of Calvary Cemetery. These were copied in 1945 by Sadie L. George, and a copy is in the Genealogy Department of the Denver Public Library.
5. Hall, Frank, 1889, *History of the State of Colorado*, 4 vols., v. 1, p. 458. Chicago: Blakely Printing Co.
6. Last two lines of the poem "Streets Due West" by Thomas Hornsby Ferril.
7. Byers, William, 1901, *Encyclopedia of Biography of Colorado*, v. 1, p. 307. Chicago: Century.
8. *Wright v. Morgan*, 191 U.S. 55, 48 L. Ed. 89.
9. Two of the transactions that had shrunk the 20 acre tract to 18 acres were (1) April 28, 1937, the city purchased a right-of-way to run some water pipes through the cemetery for \$2,500 and agreed to move 50 bodies therein for another like amount; and (2) land was used from the Calvary Cemetery when York Street was cut through.
10. *Rocky Mountain News* March 21, 1956.
11. Petersen, Bernice E. "Silver Jubilee Records Progress, Denver Botanic Gardens" in *Annual Report, 1975 of the Denver Botanic Gardens*. This reports in detail the history of horticultural societies in Denver which culminated in the Denver Botanic Gardens Foundation.



Mountain View from Cemetery

Small Fruits in High Altitude Gardens

W. B. Pings

Small fruits can be an extremely rewarding addition to the kitchen garden. Strawberries, red raspberries, currants, and gooseberries are the most dependable of the small fruits for Colorado gardens at high altitudes, and all of these usually will produce well at elevations up to 9000 feet. The tree fruits (apples, cherries, pears, plums) have been found of questionable and variable hardiness at altitudes of 7500 feet and above, and are not considered in the present discussion. Serviceberry, chokecherry, and elderberry are native fruits that also are hardy at high altitudes, and can be grown readily under cultivation. Some named varieties of these fruits are being offered by nurseries.

In general, any of these essentially permanent plantings should be set off from the main vegetable garden so that they will not be damaged during the yearly tilling process. Some of them can be used advantageously in the landscaping scheme.

Growing Strawberries

Strawberries are the most popular small fruit in the world, and probably no other fruit except the apple is so widely distributed. The popularity of the strawberry is understandable: it is remarkable in producing a full crop of fruit in just a little over a year from plants set in the spring; no other fruit will produce a crop so quickly. Selected varieties will perform well in every region of the United States and are grown worldwide in areas ranging from Fairbanks, Alaska, with severe winters, to Pretoria, South Africa, with a long hot growing season. Strawberries can be grown in a strawberry barrel or pyramid, in pots, as a border in the flower garden, in beds or in garden rows, and are of course a valuable commercial crop. They are adaptable to a wide range of soils, requiring chiefly good drainage and at least 8 hours of sunlight daily; full sunlight of course is preferable.

Biggle (1913) gives this tribute to the strawberry: "Doubtless the Lord might have made a better fruit than the strawberry, but doubtless He never did." "Being the first fruit to ripen, the strawberry comes to the table as a welcome visitor when the appetite is capricious. So beautiful in form, color and fragrance, it is among fruits what the rose is among flowers. In flavor so delicious, in healthfulness so beneficial, that invalids often gain strength while its season lasts. . . ."

Two kinds of strawberries are available, the main-crop and the everbearing. The main-crop types bear a single crop early in the summer, and at lower elevations are often described as "June-bearing" strawberries. Almost all commercial plantings are of this type. The everbearing kinds bear some berries at about the same time as the main-crop, then intermittently throughout the summer, and (usually) a somewhat smaller crop in the fall. The main-crop type is preferred by the author on the bases of better total yields of berries, ease of harvesting the crop, and avoidance of loss of berries by early fall freezes. The everbearing types are said to be slightly more hardy than the main-crop varieties, so are often recommended for higher elevations, although they usually produce less total crop, particularly since fall frosts often prevent full development of the late berries.

A strawberry plant is a true perennial, and the same plant bears the summer crop, the fall crop (if everbearing), and any crops produced in subsequent years. Strawberries propagate by runners sent out from the parent plant, and if allowed to remain on the plant, each runner will make one or more new strawberry plants. Any good garden soil will grow strawberries, but a sandy loam is best, and poor drainage or a heavy clay soil may lead to disease. To prevent or minimize damage from root grubs, it usually is recommended that strawberries should not follow corn, weeds, or grass, and that they should not be planted on land that has grown strawberries during the previous three years. The best practice is to have strawberries follow a clean-cultivated crop grown the year before. However, the author has grown strawberries continuously on the same plot of ground for the past five years with no evidence of disease or insect damage.

A general rule for culture of strawberries is that they are grown to give two crops of berries in a three-year period, then a new bed is established. The general consensus is that the yields and quality of berries from older plantings are almost always disappointing, and there are even some recommendations to turn under the plants after the first fruiting year. This practice is thought to prevent the introduction of viruses from the wild, and to avoid the build-up of nematodes in the soil.

Cultivation should be frequent and shallow in the first year of growth, but only after bearing in subsequent years. Deep watering to 6-10 inch penetration is essential during the growing season and again in late fall before winter protection is applied. Fertilization should be done in the fall after harvesting the crop, and may be barnyard manure applied at the rate of about one pound per square foot plus some additional superphosphate, or a commercial fertilizer such as 5-10-5 or 6-10-4 applied at the rate of about 1/4 pound per square foot. Potash, which contributes to plant hardiness and to the development of starches and sugars, is a good side dressing for strawberries, and fireplace ashes make a good source.

Winter protection involves application of a mulch, usually straw, early in the winter after the ground is frozen or when the average temperature is down to about 20°. The function of the mulch is to keep the ground frozen so as to prevent alternate freezing and thawing that might heave the plants out of the ground, and to prevent too-early growth in the spring when late frosts might injure the plants. In the spring after growth starts, part of the mulch should be removed, leaving a portion between the rows and around the plants to conserve moisture and to keep the ripening berries off of the ground.

Specific Cultural Practice

Two general methods are used to grow strawberries: the hill system and the matted-row system, either of which may be used for either type of strawberry. In the

hill system, each plant is maintained as a single entity, and no runners are allowed to develop during the first two years. In the third year, enough runners may be permitted to give the desired number of plants if it is desired to establish a new bed. In the matted-row system, runners are allowed to develop from all of the plants during the first year to give a matted row of plants 12-15 inches wide. The hill system gives a generally neater appearing bed that is easy to cultivate, and produces berries that are larger and easier to pick.

HILL SYSTEM. Plants are set out in the spring, about 18 inches apart in rows 24-30 inches apart. Fall planting is not recommended unless pot-grown plants are used so there is no transplanting shock at the time of year when the plants are entering a



Strawberry

period of maximum stress. During the first year all runners are removed and all blossoms are picked from the main-crop types; everbearing varieties may be allowed to set some blossoms after July 1 for a fall crop. Cultivation should be frequent and shallow during the first year, but only after harvest in the second and third years.

In the second year, all blossoms are permitted to develop into fruit, as this will be the first major crop production, but again all runners should be removed. In the third year all blossoms are permitted to develop into fruit, and each plant may be allowed to set one or two runners to make plants for a new bed if it is desired to continue the variety. After the fruit is harvested and the runners are well rooted, the runners can be separated from the parent plants and the old plants dug out and destroyed. If the variety is not to be continued, all of the plants should be removed after harvest and a cover crop such as winter rye planted to prepare the soil for planting the following spring.

The yields obtained with Sparkle, a main-crop strawberry, grown in Evergreen using the hill system, may be of interest. Twenty-five plants were set out on April 23, 1974, and handled according to the procedure outlined above. The yields were 15.5 pounds of berries in 1975, and 16.25 pounds in 1976.

MATTED-ROW SYSTEM. The plants are set in the spring 18 inches apart in rows 36-42 inches apart. During the first year, all blossoms are picked from main-crop berries, but everbearing types may be permitted to set blossoms after July 1. Each plant of either type is permitted to set two or three runners which should be spaced 5-7 inches apart to give a matted row 12-15 inches wide. Cultivation should be frequent and shallow before the runners are established, after which little cultivation will be possible. In the second year all blossoms should be allowed to develop into berries, and enough additional runners may be permitted to fill the matted row; no further cultivation will be possible. In the third year all blossoms should again be allowed to make berries and the runners should be controlled to prevent overcrowding.

At this time enough new runners may be selected to establish a new planting or, if it is not desired to continue the variety, the planting may be turned under and a cover crop planted to prepare the soil for further use.

There are many varieties of strawberries available, and it is well to remember that a variety useful in one part of the United States may not perform well in another area. Also, it is recognized that a variety that does well in a particular garden will not necessarily be satisfactory in a nearby garden. Accordingly, it is best to try a few varieties to determine what is best suited to your own particular growing conditions. The following strawberry varieties are suggested for high-altitude gardens in Colorado:

Main-crop — Sparkle, Cyclone, Red Crop, Robinson, Temple, Fairfax, Catskill, Arrowhead, Late Giant, Stoplight, Red Star (late season, avoids spring frosts), Empire (mid-season, frost resistant), Guardian (resistant to red stele).

Everbearing — Ogallala, Ozark Beauty, Twentieth Century, Gem, Superfection, Sequoia, Geneva, Red Rich, Streamliner, Rock Hill, Mastodon, Radiance, Arapahoe, Evermore, Fort Laramie (developed in Wyoming).

Growing Raspberries

Red raspberries are one of the easiest to grow and most productive of the small fruits, and together with strawberries are deservedly the most popular fruits for the home garden. Once established, a raspberry bed will bear for many years with a minimum of effort, unlike strawberries that must be renewed each three years to maintain high productivity. However, raspberries are very aggressive growers, and if not controlled they will soon spread to the detriment of nearby plantings; therefore they should be placed where the natural spreading will not interfere with other growing things.

Raspberries are brambles, which have perennial roots and biennial tops. There are two kinds of raspberries, the main- or single-crop, and the so-called everbearing, which for raspberries is a misnomer. The main-crop varieties produce one crop of berries on two-year-old canes, then these canes die and must be removed. The everbearing types bear a fall crop of berries on the tips of the one-year-old canes, then these same canes produce the summer crop the following year, after which the canes die and should be removed. At higher altitudes, the fall crop of berries on the everbearing types may be killed by frost before much of a crop is produced.

In the first year of growth, raspberries should have frequent and shallow cultivation, and cultivation should be continued in the second year until berries start to set. After the second year there usually will be too many shoots to permit cultivation, but heavy mulching is beneficial, and with adequate mulching little fertilization is necessary. Deep watering is essential during the growing season, then water should be withheld during late summer to harden off the new growth, and given again in late fall before the ground freezes.

Winter protection for raspberries consists in bending the canes over and covering the tips with soil, pieces of sod, pieces of wood, etc. Some instructions say to cover the entire cane with soil, but in a large patch this would involve moving very large

quantities of soil, and experience has shown that in a winter with adequate snowfall there will be sufficient protection of the canes by the snow cover. Even in those winters with small amounts of snow, the natural thinning by winterkill may actually be beneficial. In the fall before winter protection, all canes that produced that year should be cut off at ground level, and any weak or damaged canes removed at the same time.

Raspberry Culture

When a new raspberry bed is started, the ground should be prepared the previous fall with a heavy application of manure, tilling, and allowing the ground to lie rough until the following spring. In the spring a second light tilling and raking will provide a suitable surface for planting. Plants are set out in the spring about 2 feet apart in rows 6-9 feet apart, and the canes cut back to 6-10 inches. In general, no berries should be set during the first year of growth, except that everbearing types may set a few berries on the new growth in the fall. Clean cultivation should be given the first year. Berries will be produced on the two-year-old canes, then these canes should be cut off at ground level before winter protection is applied. Everbearing varieties will set the fall crop on the growing tips of the one-year-old canes.

An interesting and easy method of growing the so-called everbearing raspberries consists of allowing this type to produce only a single crop of fruit in the fall on the one-year-old canes, after which all of the canes are cut off at ground level. Using this method, there will of course be no two-year-old canes the next year to produce berries, but the one-year-old canes of that year will produce berries in the fall. It is claimed that these one-year-old canes will produce a heavier crop somewhat earlier than when they are competing with the two-year-old canes. Damage by early fall frosts should thus be minimized. Since no canes are left standing over the winter, no winter protection except mulching is needed for this system of growth. It would seem that the total yield by this method would be considerably lower, particularly at higher elevations where an early fall freeze often occurs.

Some figures on raspberry yields may be of interest to show the rapid spread of a planting. Ten Newburgh red raspberry plants, a main-crop variety, were set out in Evergreen (about 7400 feet altitude) on April 10, 1972. No berries were produced the first year, and a small crop of about one quart was picked in 1973 but the yield was not recorded. Subsequent yields from this planting were as follows: 1974, 34 pounds; 1975, 37 pounds; 1976, 43 pounds. Some winterkill was experienced during the winter of 1975-1976 because of severe winds and lack of snow cover. Present size of the patch is restricted to an area of 7 feet by 35 feet. All new canes are cut back during the summer to a height of about 5 feet to promote branching.

Protection against birds is accomplished by use of a strong netting spread over a framework to cover the entire bed to the ground. Picking is easily done by lifting the netting first on one side of the patch and then on the other to give access to the fruit. The summer pruning prevents growth of the new canes through the netting.

Some suggested red raspberry varieties for high altitudes are:

Main-crop — Newburgh, Latham, Chief, June, Boyne, Anelma (new low-growing type from Finland; hardy).

Everbearing — Indian Summer, September, St. Regis, Fall Red, August Red (from New Hampshire; very hardy).

Red Raspberry



Growing Currants and Gooseberries

Both of these closely related plants (genus *Ribes*) are hardy to about 10,000 feet elevation; it is said that they may be grown almost to the Arctic Circle. They will survive cold temperatures better than heat or dryness, although some native plants are found on dry, rocky slopes. Both are very well suited to home gardens and for landscaping, as they are easy to grow, make neat bushes 2 to 4 feet high, are self-fruitful and heavy annual yielders, will stand some shade, and do not spread as do some other berry plants. Accordingly, they may be used in the shrub border, in the vegetable plot, or in a separate area. There has been a notable lack of interest in these fruits in the United States, particularly in black currants because of their involvement in transmitting the white pine blister rust disease, and also because many people apparently find the flavor of the black currant undesirable. Black currants will not be considered in this discussion.

Both currants and gooseberries will grow on a wide range of soils, but a deep, well-drained loam is preferred. Both, however, can be adapted to a somewhat heavier soil if drainage is adequate. Currants will tolerate a wetter soil than gooseberries. Currants have been used chiefly for jelly and for juice drinks, alone or mixed with other fruits such as red raspberries, and gooseberries have been used mostly for pies. Some of the newer gooseberry varieties are said to be good for eating out of hand.

Currants and gooseberries are vigorous growers and need to be pruned annually and severely to maintain the plants for maximum production of high quality fruit. Fruit is borne on one-year-old and older canes, but the canes become progressively less fruitful with age — the quantity, quality, and size of the berries declining, so that the oldest stems should be removed after they have borne their third crop, at the end of the fourth summer. Some instructions recommend very early spring pruning, while the plants are dormant. Whenever it is done, each pruning after the third year should leave not over 3 or 4 each of three-year-old, two-year-old, and one-year-old branches (the previous season's growth), preferably leaving only eight to 12 stems.

Recommended currant and gooseberry varieties are:

Red currants — Red Lake, Fay's Prolific, Wilder.

Gooseberries — The most productive and high-quality varieties are thorny; the thornless types are said to be usually unproductive, small-fruited, and poor in quality. Best varieties are Welcome, Champion, Downing, Pixwell, and Poorman (from Utah, fruit ripens to red with excellent quality).

Growing Some Colorado Native Fruits

Three of Colorado's native fruits that are most adaptable to the small fruit planting or for landscaping are the serviceberry (variously referred to also as shadbush, shadblow, Juneberry, or Saskatoon blueberry), the chokecherry, and the elderberry. All of these are native to both the eastern and western slopes of Colorado, and will grow up to elevations of 8000 feet or above.

SERVICEBERRY. The genus *Amelanchier* has many species that are very hardy and are widely adapted to a wide range of soils from acid to alkaline, and many of them produce edible fruit. One or more species are found in every state of the United States and in every province of Canada, and the plants also are widely used in Europe and in northern Asia. *Amelanchier* was one of the fruits most used by the American Indians and by the early settlers of North America, particularly in the making of pemmican.

Plant growth may vary from a dwarf shrub to a small tree, the plants flower very early in the spring, and the fruit usually is dark blue to black covered with a white or gray bloom similar to a blueberry. The fruit is juicy, often characterized as mild or insipid in flavor, good for eating out of hand, and occasionally is used for jams, pies, and sauces.

CHOKECHERRY. The western chokecherry *Prunus virginiana* L. var. *melanocarpa* (A. Nels.) Sarg. is abundant on the eastern and western slopes of Colorado and has been used since the time of the early settlers for making jelly and wine. The plants are hardy to about 9000 feet, but at higher altitudes the blossoms are often damaged by late frosts and no fruit is produced. The plants often form a dense thicket, and growth habit may be from essentially a shrub to a 20-30 foot tree. The spring blossoms are distinctive for their long drooping racemes and strong fragrance.

The chokecherry apparently is adaptable to a range of soil types, and is said to grow on a sticky blue impervious clay along the St. Lawrence River. Some relatively large fruited (1/2 to 3/4 inch) varieties are cultivated to some extent in the lower provinces of Canada and adjacent United States by French Canadians for making jellies, sauces, preserves, and liqueurs. Chokecherry plants are not widely available, but are offered as specialty items by a few nurseries, and seedlings of Schubert are offered by a Golden nursery.

ELDERBERRY. The native Redberried Elder *Sambucus racemosa* L. ssp. *pubens*, with red berries, is hardy to 10,000 feet. The American Elder *S. canadensis* L., with black berries, is not a native, but can be grown up to about 8000 feet. Both are rather coarse and rapid-growing shrubs. Cultivated elderberry varieties such as Adams, obtainable from some nurseries, are claimed to produce better fruit than the wild plants. Elderberries are said to require cross fertilization, so that it is advisable to plant two or

more varieties for proper pollination. The black fruit has been used for pies, for jelly, and for wine, and it is reported that wine can be made from the blossoms in much the same way that it is made from dandelion blossoms.

Elderberries grow very vigorously and tend to spread when growing conditions are proper, so have not been much used as ornamentals or in landscaping. A mature plant may reach 8 feet in diameter if allowed to spread. The creamy white flowers are attractive, as are the red or black berries, so the plants are suitable for a property corner or along the edge of a lawn where they can be kept within bounds by judicious pruning. Full sunlight is desirable, but the plants will tolerate some shade. A well-drained slightly sandy loam is the best soil for elderberries, although they may be grown on a wide range of soil types as long as drainage is adequate. To prevent mildew, the air drainage also should be good. A good moisture level throughout the growing season is essential for best fruit production. The plants will survive on dry soils, but they will be small and will not produce many berries.

A mature elderberry plant will send up a number of shoots from the ground each year, which will bear the next and following years. The older stems should be cut off after the third year, when they become weak and unproductive. Cutting back the tips of the new shoots will encourage branching and increase fruit production. Shoots that come up too far from the desired location can be grubbed out or can be transplanted if additional plants are wanted. Mulching is recommended to help conserve moisture, and moderate fertilization will encourage continued fruit production.

Some suggested elderberry varieties are Adams, New York 21, Nova, Johns, York, and Scotia. The author has no first-hand information about the performance of these varieties in the Denver area.

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Roadside Gardens

Editors' note: This article is reprinted by permission from Oklahoma Today. The Oklahoma effort to beautify the highways seems to be of real value.

Joanne S. Orr

What saves fuel and money, beautifies the roadside, wins friends, gladdens the heart of the motorist and is pink, purple, yellow, red, white and blue? The Roadside Wildflower Program that is bursting into bloom all along the rights-of-way of Oklahoma's highways. Noted for fields of waving wheat, Oklahoma has now established a national reputation for fields of waving wildflowers.

During the weekend wandering down the state's roads this spring travelers will be overwhelmed by the sparkling yellow coreopsis that springs from the hillsides and rocky cuts of the Arbuckle Mountains. Vivid orange-red Indian paintbrush carpets the medians and roadsides from Henryette to Duncan. Indian blanket (gaillardia) gathers in bright masses of bloom from Elk City to Sallisaw.

These roadside panoramas are no accident. Rather, the Oklahoma Department of Highways has embarked on a highway beautification project designed to turn the Sooner state into a collage of spring and summertime color. Benefits of the program have exceeded everyone's dreams. Highway Director R. A. Ward reports the savings in cost of mowing roadsides and the wave of community spirit engendered by the program. The

Department is providing guidance to other states contemplating similar programs.

The program is a beautification effort in which the Oklahoma Department of Highways plants all wildflower seed donated by garden clubs, civic groups, Boy Scouts, individual citizens, etc. The seed may have been purchased or harvested. Working together, sites are selected, then planted and marked with signs by the Department. Planting is done by department crews. Equally important is the policy of delayed mowing through which native wildflowers are allowed to go to seed. What began on a small scale in 1974 has expanded to include many citizens of the state, from those who appreciate the new-found beauty to those who volunteer many hours to help the program succeed. The program is setting state roadsides on a path back to the natural grasses and flowers of pioneer days. Because of unique growth conditions there are over 4,000 species of wildflowers native to the Sooner state.

Oklahoma also presents a challenge to would-be Johnny Appleseeds with its wide variations in rainfall, temperature, and soil conditions from east to west. In the Panhandle and western counties an

average of only 16 inches of rain falls per year and yucca abounds in the dry, sandy soil. In the rolling hills of eastern Oklahoma moisture-loving plants can enjoy some 56 inches of rain per year.

Landscaping en masse — as wildflowers do — is low in cost and particularly appropriate to highway beautification. Formal spot plantings of one redbud, two forsythia and three tulip trees cannot be appreciated at 55 mph. They also require expensive hand pruning and time consuming gymnastics by mowers wending a path around the beds.

Delayed mowing is the key to the encouragement and expansion of the many flowers abounding along Oklahoma roads. The dramatic increase in flower vistas in the spring and summer of 1975

was a direct result of the delayed mowing policy begun in 1974.

The right-of-way on the 12,000 miles of state highways used to be mowed from fence to fence somewhat like a golf green. Now, under the Highway Department's delayed mowing program, flowers are allowed to bloom freely and go to seed naturally before the mowers begin to roll. After the flowers have gone to seed, mowing procedures return to normal and roadsides are prepared for winter by state highway maintenance crews. Safety of the motorist is paramount. Areas near intersections, guard rails, curves and signs are mowed year round whenever necessary to maintain adequate sight distance for drivers.

The Wildflower Program includes all



Oenothera caespitosa Nutt.

state highways, except where they pass through cities. City crews do the maintenance on state highways within city limits. However, the State Highway Department does all maintenance on interstate highways, wherever they are located.

Beauty is not the only attraction of the Roadside Wildflower program. Energy conservation results, along with economic benefits. The cost of diesel fuel has doubled since 1972. Savings to taxpayers as a result of delayed mowing have totalled about \$700,000 over the last two seasons. Cost of planting seeds and placing signs has been a nominal \$3,256 since the Wildflower Program's inception.

In the summer of 1973, Tulsa Garden Club members visited the Oklahoma Highway Commission. They suggested that state garden clubs help beautify roadsides by donating wildflower seed. From the beginning, the public's reaction was favorable. A concerned citizen wrote to inform the Department that he was "disappointed to see how we have neglected to keep the weeds cut on I-35," but his opinion was the exception; most citizens were enthusiastic and understanding of the "shaggy" period when flowers were going to seed. A housewife from Stillwater wrote, "being a naturalist and conservationist, I take pride in Oklahoma's accomplishment." A Bristow doctor wrote, "I have enjoyed Oklahoma's highways very much this spring. They've been beautiful — from the Indian paintbrush along highways near Ardmore to the red daisies along our Creek County roads. Let's don't ever 'scalp' our rights-of-way in the springtime again."

The Department's problem has been in learning how to grow wildflowers from seed on a large scale. Green "Wildflower Plot" signs were designed to mark areas of new plantings, but these plots sometimes failed to produce. The first year the problem was caused by sowing in January and February. Now, groups wanting to

participate in the program are asked to buy or harvest seed early to enable crews to plant in early fall.

Test plots have been set up in Oklahoma City and Tulsa on highway rights-of-way. A blue-ribbon committee of horticulturists and expert hobbyists from around the state provided specialized knowledge of plant growth characteristics and other data that aids the maintenance crews. A particular effort is made to plant only wildflowers that will be compatible with cattle and farmland. Butterfly weed for example, very beautiful, yet very poisonous to cattle, would be planted only in industrial areas.

The learning period takes time and patience, but the beautification of Oklahoma's roads is a long-term project. Another chapter in the story is titled "Harvest." In order to expand the program, clubs and youth groups are encouraged to harvest desirable wildflower seeds for planting by the Highway Department. Enough plants are left undisturbed to reseed the original area and keep its beauty.

Harvesting will enable the Oklahoma Highway Department to plant flowers such as Indian paintbrush, evening primrose and others whose seed is not available commercially, or is extremely expensive. Verbena seed costs \$9 per ounce.

The Department has detailed instruction sheets available on request. They include information on where to contact Oklahoma Highway Department maintenance foremen, where and what kind of seed is sold in bulk quantities, harvest instructions, and general encouragement. These information sheets can be obtained by writing to Joanne Orr, Coordinator of the Roadside Wildflower Program, Oklahoma Department of Highways, Public Information Office, 200 Northeast 21st, Oklahoma City, Oklahoma 73105.

The men wearing the yellow hard hats play the major role in Oklahoma's new look but civic enthusiasm has bloomed.

Francis Ramaley

Mountain Botanist

David Ramaley

Francis Ramaley (1870-1942) was born into the family of a pioneer St. Paul, Minnesota, newspaper publisher and founder of the Ramaley Printing Company. His parents must have exerted a powerful influence on his career for he has written the following paragraph in the preface to his book *Colorado Plant Life*, a semi-centennial publication of the University of Colorado.

"More than to all others I am indebted to my parents; to my father, David Ramaley (1828-1914), in whose company as a child and youth I took long walks through woodland and over prairie and learned to know and enjoy the beauties of the world of nature, and to my mother, Louisa DeGraw Ramaley, ever interested in the intellectual life, who would often read to me for hours together when, as a student, my own eyes failed me."

In turn Francis Ramaley passed on this companionship to his own children as I well remember from boyhood when we children were taken on mountain hikes or short bicycle trips around Boulder and introduced to some of the interesting facts of nature. Indeed, to keep up this companionship with his sons he purchased a bicycle and rode with them at a time in life style when adults riding bicycles were looked upon as somewhat odd.

Frank, as he was then called, has related to me the pleasure of the day when he first discovered he had learned to swim. It was a windy day at one of the many lakes when he found that in going with the waves he was able to paddle along without touching the lake bottom with his feet. Water sports were important to the family. Frank's uncle, John Ramaley, operated a pavilion at White Bear Lake and Frank and his three brothers were sailboat and rowboat enthusiasts and enjoyed lake fishing also. In the winter on the frozen lakes iceboat sailing and racing were popular sports. My

father was an active participant in the annual St. Paul Winter Carnival pageants. He would be either an attacker or defender in the opposing armies in the siege of the frozen Ice Palace. The mock weapons used were Roman candles and skyrockets.

Walking was an activity which he followed throughout his life. As a youth he was advised by his doctor to spend an hour each day exercising by walking, regardless of the weather. Frank followed this schedule for about a year and then found that less walking time was satisfactory. However he had developed a liking for this activity which was manifest in his later years by frequent hiking trips and short walks as well. His diary of the time shows that on June 5, 1899, accompanied by Dr. Hellem's of the University faculty, he climbed up the cog railroad to the summit of Pikes Peak to witness the sunrise.

After completing high school at St. Paul, Frank worked for a time in his father's printing establishment where he became experienced in type setting and as a press operator. Not wishing to make a lifetime career of the printing and publishing business, Frank decided to study law. Possibly his enjoyment of Latin influenced this choice as he was an ardent student of the Latin classics. Fortunately for the science of biology, this was not to be. In his prelaw studies at the University of Minnesota contact with his biology professors changed his choice of a career in the law to one in biology. In preparation for this he continued his graduate studies to the doctorate level and at the same time served as an instructor at the University of Minnesota.

The Professor

The big change came to Francis Ramaley when he received an appointment in 1898 to teach courses in biology at the University of Colorado. Professor John Gardiner who was in charge of the Department of Biology was suffering from ill health and required someone to relieve him of part of the load. My father always spoke of Dr. Gardiner as an outstanding biologist and expressed much regret that soon thereafter Dr. Gardiner was forced to retire because of illness. This left my father with the



Dr. Ramaley in C.U. Greenhouse

responsibility of the Biology Department. He was determined to continue the good work of Prof. Gardiner and to build up an excellent teaching and research staff in the biological sciences.

Father had taken quarters at Wilder's Boarding House, located some distance from the University. Father obtained his exercise in walking back and forth to the University, sometimes under very windy conditions; in fact so windy that one day the wind whipped off his eye glasses which were never found.

Short trips in the vicinity of Boulder commonly were made in carriages rented from a livery stable. During these first years in Boulder. Dr. Ramaley made a number of excursions around the eastern slope of Colorado. One of these was a camping trip to Box Elder Canyon which was of special botanical interest to him. Another trip took him to the Estes Park area. His diary of 1899 contains a number of references to trips made, faculty and other meetings, student activities and other items such as might concern a faculty member. It was in this year that Dr. Ramaley first became acquainted with his bride-to-be, Ethel Jackson, daughter of Dr. Edward Jackson, prominent Denver eye surgeon. Ethel had enrolled as a freshman student at Colorado University. In later years Father told her that he was attracted to her even when she was a young freshman coed.

In 1901 Dr. Ramaley spent a few weeks on Vancouver Island at the Minnesota University Seaside Station engaged in botanical studies, a portion of which were published in the *Minnesota Botanical Studies*. Always the study of plants under field conditions was given a high priority in all of Dr. Ramaley's botanical research.

The Traveler and Tourist

It was in part this desire to observe plants in their natural environments that led Ramaley to undertake his extensive trip around the world starting in December, 1903. He never tired of recounting his many interesting experiences encountered on this journey. The venture was undertaken to combine both biological studies and sight-seeing. He had a strong desire to learn first hand about some of the tropical plants and thus widen his botanical horizons. I have been told that once he promised a very extensively traveled friend that he would not settle down to raising a family until he had completed such a monumental trip.

The first lap of the journey was to the Hawaiian Islands aboard the steamship Doric. I have an interesting collection of letters written to his mother while on this tour. In the first letter mailed in Honolulu he said, 'When I left Boulder I could hardly imagine that I was starting on my 'round the world tour which I had thought of for so long. And even yet it seems difficult to imagine that this is anything very extensive.'

Letters written to Dr. Ramaley's mother from Shanghai, Hong Kong, Java, and Ceylon describe some of his adventures and experiences. His botanical observations in the botanical gardens of Japan, Java, and Ceylon, written up in part for non technical readers, were published in the *Popular Science Monthly* and *Plant World*. In Japan, Java, and Ceylon he acquired a large collection of lantern slides which later he used for lectures and classroom instruction. In addition to his equipment for plant collection he carried a camera and photographed subjects and scenes of interest to him.

In a letter printed in the University of Colorado Student Newspaper, May 5, 1904

he states, "A stranger in Java goes first to Batavia and then to Buitenzorg. If he be a naturalist he is tempted to stay in Buitenzorg for the rest of his natural life. With an annual rainfall of two hundred inches, a temperature of from 75 to 80 degrees the year round and a naturally fertile soil there is a wealth of plant life not equaled elsewhere. Besides in Buitenzorg there is located the most famous of all botanical gardens with 9,000 different kinds of plants, many of them trees planted fifty or a hundred years ago." He spent much time visiting the botanical gardens and conversing with the botanists in charge.

From Peradeniya, Ceylon, to his mother he wrote, "You will see that I have now reached the place which I had chiefly in mind when I left home and it is a good place to reach because it is everything I hoped for and a great deal more besides. . . . So far as luxuriance is concerned the Buitenzorg gardens are far ahead of Peradeniya. But here the climate is much better, not so damp and muggy." In Ceylon Dr. Ramaley collected more than plants. I remember very distinctly a pretty exhibit of Ceylon butterflies on display at the University of Colorado Museum which were collected by my father at this time.

Some Special Interests

After the return to Colorado by way of Europe, my father and his chosen one became engaged and married a year later in 1906. They moved into a brand new house on University Hill which they had planned to be ready for them at the time of the wedding. To this couple were born four sons. As the family increased in size modifications and additions were made to the house.

Father continued to build up a strong Department of Biology at the University. Professor T. D. A. Cockerell, the eminent zoologist, whose specialty was entomology, joined the staff in 1904. As the institution increased in size and more money became available other professors and instructors were added to take care of the added enrollment of students.

The University Herbarium collection was one of the special projects of Professor Ramaley who encouraged the staff to improve it both by individual collecting and by obtaining specimens from other botanical collectors. At times on weekends my brothers and I would help in arranging the herbarium specimens alphabetically according to their scientific designations and keep the storage cases well supplied with naphthalene and other moth repellants.

An active interest in horticulture also was shown by Dr. Ramaley. I can remember as a boy visits to the nursery of D. M. Andrews, friend of the family, who maintained an excellent collection of plants, shrubs, and trees which could be grown in this area. A relative by marriage, Leslie Paul, who had been teaching horticulture at the Colorado Agricultural College, was a frequent visitor with my father. These two would discuss together among other botanical topics the growing of ornamental shrubs and trees. Sometimes they would look at some of the herbarium collections or inspect together a small nursery plot of ground which was on the campus and referred to by us, somewhat facetiously as the botanical garden. Here my father maintained a variety of plants, shrubs, and small trees for a number of years as I remember. However I recall little else concerning the project other than my father's explaining to visitors the object of the undertaking.

Greenhouse studies and experiments were high on the list of Dr. Ramaley's priorities. He had the University construct a greenhouse which soon was filled with all manner of plant experiments. As a pre-teenage boy I spent parts of weekends in this

greenhouse, supposedly helping my father, but probably just keeping out of mischief. Of high interest to my father were the effects of artificial light in extended periods on the growth and development of various plants. Beginning about the end of World War I he ran a series of tests on the exposure of over one hundred species of plants to various lighting conditions using the greenhouse and also rooms which could be darkened.

Of all of his professional interests first came either his field studies or his enjoyment of teaching. He always carried a full teaching load in addition to his research. Some of my pleasant experiences over the years have been encounters with former students of my father, sometimes quite unexpected. These former students have told me how much they, had enjoyed their class work with Dr. Ramaley. Courses which he taught included not only botany, zoology, and ecology but also animal histology, embryology, and for a time a course in hygiene. In fact he extended into the field of public health so far as to be a co-author with Dr. Clay E. Giffin of a book published in 1913 entitled *Prevention and Control of Disease*.

Dr. Ramaley found great satisfaction in his studies of the native Colorado flora. His many field excursions convinced him that a mountain laboratory would be a valuable asset to the University in that it would offer actual field experience to students and give them training in biological research procedures not afforded by the usual college curriculum. To this end he established the Summer Mountain Laboratory of the University of Colorado in 1909 at Tolland where he had made some previous studies of plant zones and relationships to environmental conditions. Tolland is located in South Boulder Park in full view of James Peak, named after the famous botanist, Edwin James. This Tolland laboratory operated for ten years before the permanent University Camp (now known as the Institute for Arctic & Alpine Research) was established between Nederland and Ward. At University Camp geology courses as well as biology were conducted. In 1923 Francis Ramaley compiled and printed a list of all the plants which had been observed in the vicinity of the University Camp from the Montane, Subalpine, and Alpine zones.

Students attending the Tolland laboratory were instructed by their professors right out in the mountainous surroundings ranging from the Montane zone to the Alpine heights above timberline. Back in the laboratory the students had the use of microscopes and other equipment to complete their outdoor field work.

These summer classes gave rise to some amusing incidents. Some of the local residents looked somewhat askance at these instructors and students who carried butterfly nets and equipment to collect and preserve plants. Once when Professor Robbins had climbed a tree to measure the relative humidity with a sling psychrometer someone came up to my father under the tree with the demanding question, "What is that fool doing with an egg beater up in that tree?" The laboratory was jokingly referred to as the "bug house" by the local residents. I understand my father was nicknamed Frogs Ramaley although no one ventured to address him thus in person. He no doubt acquired this nickname from some of the humorous tales concerning comical frog characters he used to recite as entertainment for social gatherings and campfire parties.

Father had certain favorites among the plant kingdom about which he liked to talk to us boys while we were hiking together. The ninebark shrub group was one of these. Bristlecone and limber pines were special too. Fairy ring mushrooms were of special interest also and had added attraction for a family that enjoyed a tasty mushroom meal. The several kinds of wild berries found around Tolland likewise added to

the botanical interest of the family. Father often mentioned the abundance of camomile but my memory is blank concerning our ever having made any camomile tea.



Bristlecone Pine (*Pinus aristata* Englm.)

Father, the ardent walker, often made long collecting trips. I remember one time when he hiked from Tolland to the Georgetown area to gather specimens there. The tree growths in the timberline regions above Tolland were favorite objects of interest to the professor. When he would take his sons on excursions through subalpine forests and alpine meadows, he was always interested in observing and photographing the windblown, flattened down trees at timberline. Although none of his sons became botanists, all of us gained an appreciation of the world of plants and animals.

The year 1917 was outstanding for the Ramaley family. Father took the spring semester off and arranged to teach some summer classes at the University of California at Berkeley. In the spring we spent almost three months at Sacramento where Father was engaged in botanical collections and studies in the Sacramento Valley. To facilitate his work he purchased an automobile, and the family sometimes accompanied him on his collecting trips. We then moved to Berkeley for the Summer School Term. It was on one of his excursions on the San Francisco Peninsula that he became especially interested in sand dune and sand hill vegetation that in later years occupied much of his attention in the San Luis Valley and Roggen, Colorado, areas. The summer was finished with a trip to Puget Sound to visit relatives of Mother. Mother and the boys traveled there by coastal steamship. Father was not desirous of ocean travel and made the trip by land by way of Crater Lake, Oregon.

Later Research

In later years much of Dr. Ramaley's research was devoted to the San Luis Valley vegetation. Frequently on excursions to this area he would be accompanied by one of his sons or a graduate student in biology or an instructor. This project was his final work and was published during his terminal period of hospitalization in 1942. In an article in the magazine *Madrono*, October, 1942, Vol. VI, No. 8, pages 260-265, Dr. Edna L. Johnson has listed the complete bibliography of Francis Ramaley's publications. These consist of about 90 scientific papers, some 70 primarily in the field of plant ecology, and several books. Other excellent obituary articles appeared in *Ecology*, Vol. 23, No. 4, pages 385-386 written by Prof. W. W. Robbins and in *Science*, July 31, 1942, Vol. 96, No. 2483, pages 102-103, written by Prof. Gordon Alexander.

Dr. Ramaley, although primarily a teacher and researcher, never shirked the administrative duties which were placed upon him by the University. Several times he served as Acting Dean of the Graduate School and also the School of Pharmacy. In 1902 he was Acting President, Committee work demanded a considerable amount of his time. During his years at the University he was the editor of the *University of Colorado Studies* and for 20 years secretary of the Arts and Science Faculty. Other activities included the Council on Research, Council on Honors, and the Sophomore English Test Committee.

Dr. Ramaley belonged to a number of scientific and scholarly organizations including the American Association for the Advancement of Science, American Society of Naturalists, Botanical Society of America, Limnological Society, Society for Experimental Biology and Medicine, the Colorado-Wyoming Academy of Science, and the Ecological Society of America in which he served terms as Vice President and President and later as Botanical Editor of the magazine *Ecology*. He was instrumental in acquiring chapters of Phi Beta Kappa and Sigma Xi for Colorado University in 1904 and 1905 respectively. As a citizen of the community of Boulder Dr. Ramaley served as a member of the school board for many years and contributed to community projects, and in later years served on a board of church trustees.

Dr. Ramaley's views on education included the belief that some individuals are not inclined to or suited for college instruction but enroll because such is the fashion or think that social prestige or monetary gains will be forthcoming. Prof. Ramaley recognized the need for good workers trained in the crafts and trades. He thought that training for such occupations would be more of an asset than the expenditure of resources on academic studies for those young folks who really do not care for college level instruction. He considered that a well rounded college course could develop in a student his or her greatest potential for future achievement. Service he always stressed as the goal for an educated person and was instrumental in guiding young folks into such careers as medicine, teaching, government service, or occupations affiliated with organizations and companies rendering worthwhile services.

GARDEN MEDITATIONS

Dedicated "To My Friends at the Denver Botanic Gardens," *Garden Meditations*, an inspirational book by Josephine Robertson, would be a delightful gift for garden lovers.

This new volume, Mrs. Robertson's ninth book, includes 30 short chapters, among them are "Survival," dealing with flowers above timberline; "Is Our Gardening Ever Done?" starting with Thomas Jefferson's words, "Though I am an old man, I am a young gardener," and "Dried Materials" describing the pre-Christmas sale.

Jo Robertson is a frequent contributor to *The Green Thumb*, *Christian Science Monitor*, and other publications. Abingdon Press also published her earlier *Meditations on Garden Themes*. The book is available at the Denver Botanic Gardens Gift Shop. **BEP**

Focus on

Caryota mitis

in the

Boettcher Memorial Conservatory

Peg Hayward

The tree family of palms, *Palmae*, ranks second to the grass family in economic importance; however, the palms are applied to a far greater variety of everyday human needs than any other group of plants. Palms are an ancient group of plants. From fossils we know that they were present in the Age of Dinosaurs, and formerly grew in nearly all parts of the world. There are more than 1500 different kinds of palms. Although the many kinds of palms vary in form and size, they have a characteristic appearance that enables laymen to recognize most of them without difficulty.

The famous fishtail palms, *Caryota*, are among the most widely used of all the palms introduced into the United States. *Caryota* has many characteristics uncommon to pinnate palms. It is the only palm to have doubly pinnate leaves. The axis of the leaf bears not leaflets but secondary axes along which the leaflets are spaced; and these leaflets

have not the long, narrow, tapered form but are dilated outwards with many veins radiating to a jagged, toothed margin. They appear as broadening fish-tails which gives rise to the common name for the genus.

The fishtail palms have an odd manner of flowering. They are mono-carpic, that is, when the plants reach maturity, the first flowers appear. Flowering begins near the top of the trunk and continues downward until the lowest branches are reached and the foodstuffs stored in the trunk are exhausted. When the lowest fruits ripen, the trunk dies. In single-trunked species, this means the end of the plant, but in the multiple-trunked, only one trunk dies at a time. The flowering period may last 5 to 7 years.

Caryota mitis Lour., tufted fishtail palm, native to Burma and Malaya, is represented in the Boettcher Memorial Conservatory collection. This is a cluster-forming palm with a number of

slender stems rising 20 to 40 feet high. Its larger relative *C. urens* L., a single-trunk species, may reach 60 feet or more in the tropics. The trunks are covered with long, pointed leafstem bases and black fiber matting. After these have worn away, the trunks are smooth and are marked with dark ring-scars set well apart.

Inflorescence is a dense mass of hanging spikes bearing flowers in a spiral, a female flanked by twinned males. The flowering stalks of *C. mitis* are 1 to 2 feet long.

The outer covering of the red globular fruit contains stinging needlelike crystals which can be irritating to the skin. The fruits of *Caryota* are eaten by birds, squirrels, and jackals in spite of the crystals in the pulp which irritate the human mucosa almost beyond endurance.

In its native land the tough fibers of *Caryota* are useful for making ropes,

baskets, and brooms. Toddy comes from the sap of *C. urens*. The pith of the trunk is equal to the best sago of commerce and great quantities of jaggery sugar are produced from the sap. The fluff which can be scraped off the leaves and sheaths is used as tinder.

Ornamentally the *Caryota* make fine plants in tubs inside because of the attractive design of the leaflets. A specimen tree with its graceful crown of leaves is equally effective projected against the sky outdoors.

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Caryota mitis Lour.

Exotics of COLORADO

Mullein

Verbascum thapsus

Helen Marsh Zejner

Tall spikes of mullein (*Verbascum thapsus* L.) silhouetted against the sky are a common sight at this time of year. Even at a distance mullein is easily recognized by its tall floral spikes which may persist through the winter.

Verbascum thapsus belongs to the figwort family, Scrophulariaceae, noted for its characteristic two-lipped snapdragon-like flowers. Mullein is an exception to this general rule and has flowers which lack the two-lipped structure and are nearly regular. The small yellow flowers themselves are not showy but the spike, sometimes 6 feet high, is rather spectacular.

Mullein is a biennial with attractive pale green woolly leaves. The first year a rosette, sometimes as large as a dinner plate, is formed. The second year the tall floral spike shoots up.

This is a very familiar plant and one to which we seldom give a second thought. It is, however, an exotic with an interesting history. Native to Europe and Asia, it is said to be one of the most widely distributed of all flowering

plants. Legend says its point of origin was Thapsus in the Mediterranean. It is to be found throughout the United States. It often grows on dry slopes such as road cuts and on abandoned cultivated land. It has many ancient medicinal uses, and perhaps was brought to this country to be used in simple home remedies.

Verbascum thapsus is said to have demulcent, emollient, and astringent properties and to possess slightly sedative and narcotic properties. It is also said to contain potassium. Even today the leaves are sometimes used in cough syrups and in herbal tobaccos.

From very earliest times, the leaves of mullein were used for treating respiratory tract ailments and lung diseases. Mullein leaf tea is one of the most ancient remedies for coughs and colds. Mullein was grown in Ireland to provide leaves for treating "consumption". Because the hairs cause itching in the mouth, the tea was always strained through fine cloth. Dried leaves were smoked to relieve asthma and the irritation of respiratory mucus membranes.

Although the main uses were concerned with respiratory problems and lung complaints, mullein was considered somewhat of a cure-all. Among other uses for the leaves was the relief of diarrhoea and hemorrhoids.

Tea from the flowers was used for mild catarrh, colic, ringworm, and burns. Oil in which flowers were soaked was used to treat frost bite, bruises, earache and eczema of the ear, and inflammation of the inner ear. Distilled water from flowers was used for gout. The dried flowers were made into a poultice for wounds.

Warts were treated with juice and powder from dried roots. A decoction from roots was used for toothache.

Seeds and leaves were boiled in wine and used as a poultice to draw out thorns and splinters.

Not all uses were medicinal. Roman women dyed their hair a golden color with an infusion of the flowers. Mullein ashes made into a soap were believed to restore grey hair to its original color.

Seeds were said to intoxicate fish when thrown into water and were used by poachers to stun fish.

Hairs on leaves and stem can be used for tinder when thoroughly dry. Leaves were used for lamp wicks, leading to the common name candlewick plant. Stalks were dipped in melted suet and burned at funerals or just to provide light.

Long ago in Europe and Asia, people believed that the tall wand of this plant had the power to drive away evil spirits. Ulysses, we are told, took mullein with him to protect him from the wiles of Circe.

There are at least 40 English names for *Verbascum thapsus*, including mullen, common mullen, mullein, great mullein, velvet or mullein dock, hedge-taper, candlewick plant, feltwort, torches, flannel leaf, clown's lungwort, and bullock's lungwort.

Mullein, which is *moleyn* in Anglo-Saxon, *molen* in Old French, is derived

from the Latin *malandrium* which was applied to diseases of cattle and to lung diseases, according to Gerard writing in 1597. This resulted in common names such as bullock's lungwort. *Verbascum* is from the Latin and is a corruption of *barbascum*, from the Latin *barba* (a beard) referring to the hairy foliage. Linnaeus gave this name to the plant in *Species Plantarum*, 1753.

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Verbascum thapsus L.

Looks at Books

Elmore, Francis H., and Jeanne R. Janish. 1976. *Shrubs and Trees of the Southwest Uplands*. Southwest Parks and Monuments Association, Popular Series No. 19. Globe, Arizona. \$6.95.

For a good many years I have traveled the Southwest uplands and have taken many college classes to the area. I have found the paucity of accurate, up-to-date information on woody plants most frustrating. But in this new publication prepared by Elmore and Janish we have just the tool for the job of identifying upland woody species. Along with three other booklets¹ for identification of the more showy flowers of deserts, mesas, and mountains, we now have a most important series for the layman botanist and nature-lover.

A word needs to be said about Jeanne Janish. After nearly 50 years of illustrating books with her accurate drawings which use "stick men" for scale, she had retired. So it was indeed fortunate that she agreed to "get back to the drawing board" for this publication.

Many of us are familiar with our own Denver Botanic Gardens' publication by M. Walter Pesman *Meet the Natives*, so we find a familiar format in Elmore and Janish. It is divided into groups of plants called "belts", each of the four belts being printed on paper of a different color to help the user of the book quickly locate the proper section. The four belts are these: Pinyon-Juniper, Pine-Oak, Fir-Aspen, and Spruce-Fir. For any one geographic area, of the very broad total area covered, these comprise altitudinal zones ranging upwards from the pinyon-juniper belt which starts about 4,500 feet (1,385 meters) to the upper part of the spruce-fir belt at timberline. The area of coverage, though even broader than shown on the map, is

generally from the Big Bend country of western Texas to the east edge of California and from northern Sonora and Chihuahua to the canyon lands of Utah and the Black Canyon of the Gunnison in Colorado.

Because of the difference in page color, it is easy to see which section has the most species — the pinon-juniper belt — and that the fewest kinds are in the fir-aspen belt. Incidentally, the "fir-aspen" is the white fir, *Abies concolor* (G. & G.) Lindl. while the "spruce-fir" indicator is subalpine fir, *Abies lasiocarpa* (Hook) Nutt. I personally find the page colors distressingly brilliant, and would have preferred the edges only to be colored. The apricot color of the pinon-juniper section is not my idea of suitable background for the drawings.

Elmore, trained in botany, archeology, and anthropology, is not only highly qualified to write such a book but in my opinion exceptionally thorough, even though he says his total list of 168 species is "not exhaustive". My first survey of the book was to look for certain species I have had trouble finding in other books of the Southwest. For example, there is a beautiful long-needle pine which I first encountered on field trips with students to southeastern Arizona. It was not described in any of the popular tree guides. Even some of the technical tree keys did not adequately describe this tree which I learned was locally called "Apache Pine" (*Pinus engelmannii*, authority not listed), but on pages 112 and 113 in the "gold pages" the tree is described, with a full-page illustration of its diagnostic characteristics. When I looked for other species which had given me and my students some trouble, I found nearly every one of them.

Users of this book will be pleased to find the excellent list of common names for each species, and in most cases the Spanish and Indian names are given.

Because the book is primarily for the amateur botanist, the author cannot be criticized for omission of authority names. In personal conversation with him, however, I soon learned that he has very complete notes on nomenclature and synonyms.

Descriptions for each species nearly always include interesting uses which have been made and are still being made of the products of these trees and shrubs. Wildlife importance is also included. Each of the write-ups is in Elmore's own words, and one wants to read and enjoy the author's pleasant style which often includes some subtle humor.

Anyone who is heading southwest and wants to get acquainted with the trees and shrubs should purchase a copy of this book and keep it handy.

Moras L. Shubert

Footnote

¹The "Southwest Series" referred to are these three earlier publications:

Arnberger, Leslie and Jeanne R. Janish. 1968. *Flowers of the Southwest Mountains*. 4th ed. Southwest Parks and Monuments Assoc. Globe, Arizona.

Dodge, Natt N. and Jeanne R. Janish. 1973. *Flowers of the Southwest Deserts*. 8th Ed. Rev., Southwest Parks and Monuments Assoc. Globe, Arizona.

Patraw, Pauline M. and Jeanne R. Janish. 1970. *Flowers of the Southwest Mesas*. 5th Ed. Southwest Parks and Monuments Assoc. Globe, Arizona.

Chwast, Seymour and Chewning, Emily Blair. *The Illustrated Flower*. 1977. New York: Harmony Books. \$5.95 paper. \$10.95 cloth.

This book features reproductions of flower art works, 9.5 by 12.5 inches, printed on good paper and most suitable for framing. Paintings illustrated in the book range from those of Redoute' to Dali. The flower illustrations represent a wide array of familiar and beloved speci-

mens. The authors have chosen to present more than one reproduction of the iris, the rose, and the sunflower.

The generic name, history, source, folklore, mythology, economic value of each plant are delineated within the text as well as the meaning of each flower in the language of flowers.

Each illustration is well identified as to artist, source of the painting, and date whenever possible. Black and white reproductions of seed catalog illustrations, woodcuts, calendar art, and other drawings adorn the pages on which the text is written.

The volume is classified by the Library of Congress as an art book, Call No. N 7680 C5496 1977, a classification richly deserved.

Solange Gignac

Lapidus, Paul. Ed. 1977. *The Greenhouse Catalog of Catalogs*. New York: David McKay. \$7.95.

For those people who are contemplating building a greenhouse, anything from a plexiglas bubble to a free standing structure, this book would bear close examination. In the first part of the book, Mr. Lapidus discusses basic information such as the type of greenhouse desired, its location, its function. This is followed by greenhouse manufacturers' advertising material which includes designs and costs. The final section consists of a good bibliography, listings of horticultural organizations, plant societies, garden club associations, and universities where correspondence courses are offered in horticulture and its many facets.

A thorough reading of this volume should prove invaluable to those making plans to purchase or build a greenhouse. The call number is SB 416 L3654.

Solange Gignac

In Memoriam

During July Denver Botanic Gardens lost two Life Trustees who died within a few days of each other.

Dr. Robert Stearns and Margaret Eppich Honnen (Mrs. E. H.), better known as "Marnie," were first elected to the Denver Botanic Gardens Board of Trustees in 1953 and 1958 respectively. After many years of very active service as trustees during the great development period of the 1960s each was promoted to the rank of Life Trustee, Dr. Stearns in 1973 and Mrs. Honnen in 1975.

We cannot here recount the innumerable ways in which they worked towards bringing the gardens to their present stature of which we are all so proud, but when we look back through the minute books we are reminded of the importance of their contributions. At the July 29 meeting of the Board of Trustees resolutions in memory of each were read and approved by unanimous vote.

Denver Botanic Gardens members, staff, and trustees are most grateful for the many years of generous service and support freely given by these two dedicated people.



Dr. Robert L. Stearns

1892–1977

Life Trustee

Margaret Eppich Honnen
(Mrs. E. H. "Marnie")

1896–1977

Life Trustee



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The Green Thumb

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WINTER 1977



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Winter Night

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Gilberta T. Anderson

Editors

WINTER, 1977

Understanding a Bad Drought <i>James R. Feucht</i>	102
How Long This Drought? <i>Walter Orr Roberts</i>	109
Drip Irrigation in Home Gardens <i>William C. Laubner</i>	112
Bromeliad Collection Honors Walter R. Smith <i>Andrew Pierce</i>	115
Alaska — 1977, Botanic Gardens Tour <i>Esther Witte</i>	118
Russian Botanists Visit <i>William H. Anderson, Jr.</i>	123
Exotics of Colorado — <i>Acer Platanoides</i> <i>Helen Marsh Zeiner</i>	124
Drought Gardening in Colorado — A Selected Bibliography <i>Mary Lederer</i>	126
Community Gardens <i>William H. Anderson, Jr.</i>	127
Index, Annual Report	131
Index, Subject	131
Index, Author	132
	101

Understanding A Bad Drought

James R. Feucht

"One day, I won't even guess when, the lawns, gardens, parks, and parkways in which Denver and some of her sister cities have taken such pride will have to depend on rainfall for water; sprinkling will be strictly prohibited."

This quote from the late Dr. A. C. Hildreth, former Director of the Denver Botanic Gardens, appeared in an article in the *Empire Magazine* on August 15, 1965. While his prediction has not quite come true, Denverites and in fact gardeners all over Colorado in the past two years have experienced conditions that may well lead to a fulfillment of this prediction. Dr. Hildreth is not the only one who has expressed concern over our often blatant waste of water. George Kelly, a horticulturist well-known by many Colorado gardeners, has been advocating water conservation for several decades, emphasizing proper landscape design and plant selection with low water use in mind rather than vast areas of bluegrass turf and sprinkler systems designed only to keep a lush lawn.

Colorado has experienced severe droughts before. In fact, according to the 1955 *Yearbook of Agriculture*, four major droughts have occurred in the Great Plains since 1880. The one that most old-timers will remember is the drought of the Thirties which has been labeled the Dust Bowl Era. The drought at that time was very severe, its effects being felt primarily by the farmers.

A drought of similar magnitude is now in progress. According to State Climatologist, Dr. Thomas B. McKee, the area west of the Continental Divide "is the driest on record, while the eastern portion is below normal though not setting any records." Despite the fact that the drought in the eastern portion is not quite equal to the drought of the Thirties, it must be kept in mind that the population explosion since the Thirties and particularly in the last twenty years, has increased the demand for water on the eastern slope more than tenfold.

Another problem is the timing of moisture. A glance at weather records will sometimes not even reveal that a drought condition exists if one looks only at the total precipitation for the year. In some years the total precipitation will be normal or above, yet a drought will occur. The biggest problem of course is the lack of reserve water in the form of snowfall. Snow survey measurements which have been collected since 1936 will show quite a variation in snow depth and water content. It is the water content that is important, not necessarily snow depth. In 1940 the Loveland Pass drainage basin showed a snow measurement of 34 inches on March 1 but a water

content of only 8.3 inches. It was even worse in 1944 with a water content of 5.3 inches but there were also high years such as in 1952 with 64 inches of snowfall and 21 inches moisture content. This past year in the same area, the snow depth was 25 inches with a water content of 9.3 inches. These records show that we have actually had worse years, but the greatest impact is in the demand for more water because of the increase in population. Most climatologists agree that a drought does not occur in just one year but can be expected to continue. Actually, the past two winters have been severely dry and these have been largely responsible for the damage found around homes and gardens.

How Drought Affects Plants

When a plant encounters drought conditions many processes within the plant that affect the welfare of the plant are changed. In addition to reducing water uptake, nutrients are also reduced. This then also reduces the photosynthetic activity which will in turn affect the plant's ability to manufacture food for growth. During drought years it is common not only to find plants wilting from lack of water but also to find plants that are off-color. This is because of the reduced availability of certain nutrient elements essential for plant growth. In Colorado, plants will often turn yellow because iron, essential for chlorophyll formation, is not available in quantities needed by the plant. Such iron chlorosis, common even in wet years in alkaline soils, becomes accentuated in a dry year. The past growing season was a typical example. Yellowing is not always the result of the loss of iron but also could be the result of reduced nitrogen intake or lack of several of the minor elements such as zinc and manganese.

Under prolonged drought, plants will not develop the growth increments that they would normally develop in wet years. Plants that would normally grow 3 feet, may only grow one-half that tall even though they may have the same number, but smaller, leaves. Plants of this kind we would call stunted, but from the standpoint of the plant, it is simply reducing growth to lessen the demand for water.

Many plants undergo temporary water stress on a daily basis. Perhaps you have noted large street trees in the heat of the day appear to be a little bit weepy. This will happen with many plants in the summer months when the evapo-transpiration from the leaves temporarily exceeds the ability of the tree to take up water. This results in the loss of turgidity in the leaves. Such trees will become more turgid later in the day when the sun goes down and the temperature decreases correspondingly. This is termed incipient wilt and is not considered harmful to plant growth.

Plants can also undergo physiological wilt. This type may not be visible as a wilting condition in the plant but usually will affect productivity. Instead of apples that turn out to be 5 inches in diameter, for example, the fruit may develop to be only 3 to 4 inches in diameter because of a water deficit that limited the fruit size that occurred at some time during the development. This type of water stress is of great concern, particularly to commercial fruit and vegetable growers.

Many housewives have also experienced that a plant will wilt when it receives too much water. Plants whose roots are submerged in too much water experience a loss of air which reduces the ability of the plant to take up water and the plant will respond in the same manner as though it were under drought conditions. This has even led to an old saying that "there is nothing more droughty than a swamp." It has been found that many swamp species of trees can tolerate the heavy clay soils in the Colorado Plains. It is not because a swamp species requires more water, rather because it has the



Plants of desert areas such as shown in this photo evade as well as endure drought. The shrubs can evade drought by going dormant — losing their leaves and enduring because of deep root systems. The cacti have shallow roots but endure because of stored water, spines rather than leaves, and a thick, waxy coating on the stems.

ability to tolerate the lower oxygen levels in the soil. Thus, willow trees will take prolonged periods of inundation of water and will also tolerate growing in extremely heavy soils compacted by equipment and foot traffic.

How Plants Cope with Drought

There has been a considerable number of investigations regarding the drought-escaping mechanisms of higher plants. As simple as drought may seem to be, the way it affects plants and the mechanisms involved inside the plants can be quite complex. Of major interest is to determine why one plant is more resistant to drought than another. This has resulted in various classifications of plants according to the way they cope with drought. The most common classification includes four types of plants: (1) Drought Escaping, (2) Drought Evading, (3) Drought Enduring, and (4) Truly Drought Resistant.

Plants that fit any of these classifications would be considered xerophytes. A drought-escaping plant may not be a true xerophyte because it may have only the mechanism of developing drought-resistant seed, the seed itself being produced at a time when drought is most severe. The plant that produces the seed, however, may not have any ability to withstand drought conditions.

A drought-evading plant is considered one that has the ability to economize on water. Some plants have the ability to cut down transpiration under drought conditions. This has been found to be true with some of the grasses of the semi-arid region. Some plants also have the ability to reduce leaf surface by curling the leaves inward as in the case of the curl leaf mountain mahogany, *Cercocarpus ledifolius* Nutt.

Drought-enduring plants are those that may not conserve water but will lose their foliage and can survive even when dried to a low level. Plants of this type are found in desert and semi-arid areas and are considered "desiccation-resistant." Examples of these

include some of the cacti and a large number of other succulents such as the common garden *Sempervivum* or hen 'n' chicks. These succulents can also be classified in the fourth group as truly drought-resistant because they have the structural ability to hold vast amounts of water in the leaves or stems. It is also found that most of the succulents have a heavy coating of wax or cuticle on the leaf surface which reduces water loss. Other plants are so structured that the stomates (breathing pores) in the leaves and stems are of a small size or, as in the case of some conifers, are sunken into the leaf tissues which will tend to reduce the amount of water lost from these pores.

There is no doubt that plants that have an ability to develop deep roots, such as in the case of yuccas, are able to withstand long periods of drought because the roots have penetrated into underground water supplies. Root depth, however, doesn't always mean that a plant is drought-resistant, and it is probably because they are not efficient in the water they utilize. A walnut or pecan will often have a very deep taproot but may not have the ability to withstand a long, dry period without some injury because it has a large, exposed leaf surface. Thus, a large amount of water is constantly being transpired. Many plants with shallow roots are very drought-tolerant because they have the ability to store water. Examples are sedums or stonecrop, cacti and related succulents.

Some plants also have developed a thick coating of hair on the leaves, particularly the lower surfaces, where the stomates are in greater numbers. It is believed that the woolly hairs on leaves, in some cases, serve to reduce water loss by protecting the stomates and creating a microclimate of more humid air in the vicinity of the stomates. This does not mean that every plant that has a thick, waxy coating or leaves covered with hair is drought-resistant because there are other factors involved.

Water Stress and Salinity

It is no surprise to find that most plants that grow in soils of high salt content are also drought-resistant. When the salts in a soil reach a certain level, moisture stress in the plant is going to be markedly increased because the concentration of salts will cause a reverse osmosis (plasmolysis). In a sense, the flow of water is reversed, moving from the roots into the soil. Few plants can withstand such conditions very long. Those that can, such as saltbush (*Atriplex*), are termed halophytes and have the ability to take salt levels that are so high that it is possible to taste the salt in the soil. Many of the plants that are salt-resistant and also drought-resistant have many of the structural modifications mentioned earlier such as reduced leaf size, coating of wax, hairiness, or an ability to reduce water loss by slowing down growth in times of stress. Such plants somehow survive until a time is reached when moisture becomes available.

Plants that are so-called salt-tolerant probably cannot withstand, in their tissues, the same concentrations found in the soils. As in drought resistance, a plant that is considered to be salt-tolerant is probably no more tolerant of the salt than most other species, but responds by slowing down its process and reducing uptake, thus evading a buildup of salts that would be harmful to it. As moisture becomes more available in the soil, salt levels also tend to reduce. The plant then can resume more normal growth.

The question then arises: Is a plant drought- (or salt) resistant or is it tolerant? Apparently, both can occur in plants, but for the most part they are resistant because they have mechanisms that help them cope with the situation. A plant that would be truly drought-tolerant would be one that would have the ability to survive drying

conditions without special mechanisms to cope with loss of water. For the most part, however, it appears that in selecting plants for drought conditions, we are looking for plants that have developed coping mechanisms, thus plants that should be termed drought-resistant rather than drought-tolerant. For example, Russian-olive not only has the ability to develop deep roots, but has waxy scales on the leaf surfaces to reduce water loss. Pines, which have sunken stomates in the leaves, also have waxy coatings and root systems that are capable of surviving extremely dry soils due to structural modification. Sage, which has a deep taproot, also has reduced leaf size and a scaly coating (producing a silvery look) on the leaf surface.

Problems Encountered in the Garden

This past growing season, many homeowners experienced "strange blights" affecting a wide variety of trees, shrubs, and garden flowers. Few of these were the result of a disease organism, although fireblight in apples and pears was severe. Most were the results of water deficiencies in the plant. It is sometimes difficult to explain how this can be when, to the gardener, watering has been conducted on a regular basis. The answer lies in understanding several conditions that may exist in that garden, or existed during the winter months. The answer is also found in how watering practices have been conducted.

Perhaps the most difficult to understand is the soil itself. Where soils have not been properly prepared prior to planting, plants will undergo a water stress more readily, but the stress may not be due to a lack of moisture in the soil — at least in the upper few inches. Ironically, the Denver Water Board's ruling on water restrictions has promoted shallow watering practices. Frequently, trees and shrubs in lawn areas that are watered for three hours every third day will suffer from a lack of water in the deeper root zones and at the same time, suffer from oxygen starvation in the shallow roots. This condition was observed in many cases this past summer.

The difficulty with any type of watering schedule or watering that is on a timeclock basis is that there is a danger of overwatering more than there is of under-watering — sealing off the soil surface and reducing air exchange. It is essential to understand how your soil will accept water before the frequency of watering can be determined. The frequency should also be changed due to differences in temperature and wind conditions. Water added to a soil that is of heavy clay and has not been improved with sand or organic matter will generally run off faster than it will run in. Watering more slowly to allow deeper penetration in a clay soil still does not solve the problem. It may reduce runoff but, as mentioned above, it will tend to seal off the soil air. Thus, it becomes apparent that it is not possible to water properly a soil that has not been properly prepared. Soil preparation becomes the key to water conservation and successful gardening. This is also the primary reason behind the successes of the organic gardener. The organic matter not only helps to retain moisture but opens the soil for the proper balance of air and also allows deeper water penetration over a given period of time. The benefits of adding organic matter, from the standpoint of nutrition, are really secondary.

A soil that is too sandy will also waste water because the water is often applied and lost below the root zone. Such soils can be improved in the same manner as a clay soil by adding organic matter, thus providing a "sponge" to hold the moisture.



This cherrystone juniper can tolerate extremely dry conditions as well as high salts by slowing down the growth rate. Reduced size and heavy waxed coating on the surface also reduce water loss.

Caution on Use of Turf Alternatives

It has been observed this past growing season that many homeowners are removing areas of lawn and replacing them with various alternatives such as wood chips, gravel, or some form of ground cover. Sometimes this has been overdone. There can be undesirable consequences in removing too much green lawn area and replacing it with light-colored, decorative materials. One consequence that becomes most apparent is the increase of the reflected light and heat. This may not be only a problem to the comfort of the homeowner, but it creates a problem for newly-established plantings as well. Such plants, not accustomed to the change in the environment, will react by producing undesirable growth, browning of the leaf margins, or some other expression of heat scorch.

The use of black plastic for mulching can also be overdone. Large areas covered in this manner conserve little water because much of it will run off and concentrate in areas where it is not needed. At the same time, some plastic films exclude air needed for the growth of roots and ultimately, soils underneath may become depleted of moisture. Periodic deep soaking of any plantings in a plastic-mulched area is essential. One method to avoid both oxygen starvation problems and the drying out beneath the plastic is to lay the plastic in strips no wider than 18 inches with an overlap, in a manner that will allow water and air to move beneath. It is also desirable to use films no thicker than 4 mils and to keep the plastic away from the "drip point" of new plants, trees, and shrubs. This is particularly important in some of the more drought-resistant plants which, as it turns out, also require a better drained soil than average or, to put it another way, need oxygen for proper root development.

Avoiding Winter Drought Losses

Many homeowners this past summer have experienced the sudden collapse of well-established trees and shrubs. This was particularly common in European weeping birch, cottonwood, willow and in some cases, honey-locust. Despite the fact that the trees had been watered along with the lawn during the growing season, the trees did not get enough water. The greatest problem comes from the long period during the winter when precipitation was extremely short and subsoil moistures had already been depleted. Major root systems of such trees perished, leaving only a small and inadequate root structure to take up water. Such trees will appear to be perfectly normal in the spring when growth resumes. Reserves in the tree are relied upon and sometimes the plant will replace enough roots to exist without too much dieback. In other cases, the tree, for one reason or another, will not replace roots fast enough and when hot weather conditions exist, the demand on the tree and its meager root system is too great, thus it will fold.

Oddly enough, watering can often cause the tree to fold sooner. It is the manner in which the tree is watered that does it. In cases where trees completely perish during the middle of the summer, it usually is the result of surface watering, keeping the lawn green but watering only enough for it to penetrate a few inches. This practice results in an unfavorable environment for root growth because it not only fails to reach the roots but also tends to close off the soil, thus allowing no air to penetrate. Without aeration, roots perish rather than flourish. This is why this year it has been widely recommended that trees and shrubs be deep-root watered with a hose-attached device such as a root feeder. This not only conserves water and puts the water down where the roots are, but it also pokes holes in the ground to increase air penetration.

Unfortunately, a root feeder is often used incorrectly. It has been a common practice to push a root feeder into the ground, turn on the water full blast and leave it for thirty minutes or more, or until the ground swells. This is a poor practice. When the ground swells, it is an indication that all the pore spaces in the soil have been filled with moisture at the expense of needed air. Placing a root feeder in three or four places around the tree in this manner simply ends up in drowning the tree.

The correct way to use a root feeder is to push it into the soil but leave it for only a minute or so and move it six to eight inches and repeat the process. This should be done in an area between the trunk of the tree and the drip line in the case of young trees. If the tree is an older, well-established one, it should be done several feet beyond the drip point. When inserting the root feeder, angle it slightly away from the tree. The idea is to put lots of holes in the ground to provide both aeration and sufficient moisture without over-saturation.

Winter watering is much more important if the winter is an "open" one as it was in the winter of 1976-77. At least one deep watering a month is advised should dry conditions continue.

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How Long This Drought?

Walter Orr Roberts

Adverse weather is the greatest stimulus to call our attention to our climate. The present water shortage, resulting from low precipitation for at least two years causes us to wonder how long it will last, and to ask "Are the world's climate patterns changing?" This is a very controversial matter among weather and climate scientists. Moreover, since a beneficent climate is probably the single most important factor in assuring that the world's food bins are full, the answer is a life-and-death matter for millions of people.

In February of 1972 camera-bearing satellites revealed the north polar cap was covered with a larger area of snow and ice than in any previous space-age year. Some climate researchers believe this may have been the first sign of the climate disasters that befell wide regions of the earth in 1972. Also, some responsible climate experts believe the bad climate of 1972 was the forerunner of what will probably turn into a long but uneven series of adverse agricultural crop years.

History tells us that world climate has undergone far greater fluctuations and changes than our contemporary ones. For example, temperatures 6000 years ago, in the northern hemisphere at least, averaged perhaps as much as 2°C warmer than now, leading to growing seasons as much as a month to a month-and-a-half longer than now in today's best agricultural lands. But twice as long ago we were in the last phase of a major ice age which brought glaciers deep within the present borders of the United States.

About 550 B.C. northern Europe's climate suddenly worsened, probably giving rise to the legend of the "Twilight of the Gods". It became colder and wetter. In about 1000 A.D., on the other hand, England's climate was warm and benign; Viking explorers were ranging the North Atlantic, and in all probability even to the mainland of North America. Shakespeare was born in a time of English climate worsening in the early 1560's. The "little ice age", which gripped northern climates from about Shakespeare's time, began to ameliorate at the end of the last century, and one of the most striking warming trends of the last millenium has occupied a good part of the lives of older people living today. From about 1890 to 1940, the northern mid-latitudes warmed by about 0.6°C and at the higher agricultural latitudes this added perhaps two weeks to the growing season. Since 1940, however, we have lost perhaps one-half of the warming.

Climate changes on every time scale. Ice ages have alternated irregularly with warm ice-free periods at time spans of thousands of years to hundreds of thousands. On every time scale down to individual years we see changeability as the real constant of climate and weather. And, in spite of the incentives, no real schemes of forecasting have yet materialized from all the scientific efforts. In fact, even the understanding of the fundamentals of climate change is rudimentary. Research to improve this understanding is of utmost priority. Agriculture and horticulture in the United States alone involve an annual multi-billion dollar gamble on favorable climate.

Causes Unknown

Until now I have said little about the causes of climate change. This is partly because they remain largely unknown. And this, basically, is why we are so painfully impotent to forecast even the gross features of future climate disasters. Floods and droughts have come unheralded. Typhoons and hurricanes can be predicted only after they are well formed and in motion, and even then the predictions of their paths are often altered almost hour-by-hour. The expectation of more variable future climate by many of our climatologists is based not in any solid physical understanding of the processes involved, but only in the properties of the statistical behavior of past climates.

Some tantalizing facts are known. For example, it appears from observations that every major outbreak of volcanic activity which throws large volumes of fine dust into the stratosphere is followed by a few years of colder weather. But many cooler periods come without volcanos. Ocean temperatures change over large areas. These changes certainly produce persistent differences in the large scale winds and through this, changed patterns of rain and wind. However, these same changes often appear without the ocean anomalies.

When Northern Hemisphere temperatures rose to their high peak of the 1940s, many climatologists were convinced it was due to the "greenhouse effect" of atmospheric carbon dioxide from the vastly increased use of fossil fuels throughout the developed world. The carbon dioxide, it was argued, acted like a window of a glass house for plants; it let in the sunlight but prevented the escape of the infra-red heat rays from the warmed earth.

But climatic conditions after 1950 seemed to dispose of that theory. The temperatures dropped even though the carbon dioxide continued to rise unabatedly. Later, some scientists concluded that fine dust particles in the atmosphere had begun to increase even more rapidly than the carbon dioxide. These dust particles, they argued, weakened the sunlight, and reduced the heating even more than enough to compensate for the carbon dioxide heating effect.

I am convinced that we do not understand the processes sufficiently well to trust either hypothesis. I am convinced that there are, moreover, a number of mechanisms which may alter climate in a given way at different times, so that we will never be able to isolate a single cause of colder or warmer climes, wetter or drier farmlands. In some cases it will be for one cause and in another for a different cause.

Sustained droughts in a large geographical region are among the worst natural scourges known to mankind. They have gross impact upon vegetation (thus, all life), and can trigger land erosion, water supply depletion, and vast human misery. The world's food reserves are precariously balanced, and one need only look at the "domino effect" of the widespread droughts of 1972 to realize the vulnerability of the burgeoning world population to drought and attendant famine.

The intense Moscow area drought and heat in the spring and summer of 1972, coming on the heels of a cold and dry Ukraine winter, was serious enough to compel the Soviet Union to purchase huge amounts of wheat from Canada and the United States. This unusual need coincided with new demands elsewhere and conspired to wipe out our surpluses. The result was skyrocketing domestic and international grain prices, with dire consequences for bread, meat, poultry, and other food prices.

In the United States, as in the rest of the world, droughts occur with irregular spacing and highly unpredictable severity in nearly every part of the country. California

has been experiencing severe drought. A decade or more ago, New York experienced severe water shortages. And now we in the Rocky Mountain states have been experiencing record-breaking deficits in precipitation.

Search for Cycles Very Old

Searches for cycles and trends in drought are as old as man's concern with them. Joseph, as recounted in the Book of Genesis, warned Pharaoh of the seven years of great plenty to be followed by seven years of famine. However, it appears that in most parts of the world droughts are not cyclical, but infuriatingly irregular. This very irregularity has made it difficult to identify their causes. Only in the rather restricted region of the High Plains of the western United States, from the Rocky Mountains eastwards for perhaps 500 miles, do the droughts show any marked recurrency, and this with a period of about 20 to 22 years. The strongly affected region embraces the relatively dry wheat lands of eastern Colorado, western Kansas and Nebraska, Oklahoma, the Texas Panhandle, and sometimes eastern Wyoming and the Dakotas. This is the region of the great Dust Bowl of the 1930s, perhaps the most severe drought of the 150-year period during which this recurrence has been verified.

This same region was affected in the mid-1950s. And the recurrence is "due" now. Since we do not know why the droughts appear to recur here, we cannot be confident in predicting the "Drought of the 1970s" (but who can say we are not experiencing it?). It is possible that the tendency to repeat with a 20-22 year spacing comes about from some still undetected interaction between the global wind system and the ocean temperatures, which results in a sort of oscillation with this period. But there is no direct evidence for this.

Some scientists, myself included, have suggested that variations in the sun's activities are connected with the phenomenon. It is well known that the sun exhibits a relatively regular 10 to 11 year periodic rise and fall in activity of sunspots, flares, coronal emission, and other characteristics. Moreover, the sunspots and the general magnetic field of the sun display different magnetic polarities in the alternate 11 year cycles. Thus, there is a real physical sense in which the solar activity exhibits a 22 year recurrence. But there is no plausible explanation of how this could affect the weather in the High Plains.

So, unless and until we discover what factors are important and how to combine such information for the improvement of forecasting, we cannot say how long our present drought will last nor can we even say whether we have reached the low point in this cycle. What this means is that we should prepare for the worst and be thankful when the rain and snows return.



Pediocactus simpsonii (Englm.) Britt. & Rose

Drip Irrigation

In Home Gardens

William C. Laubner

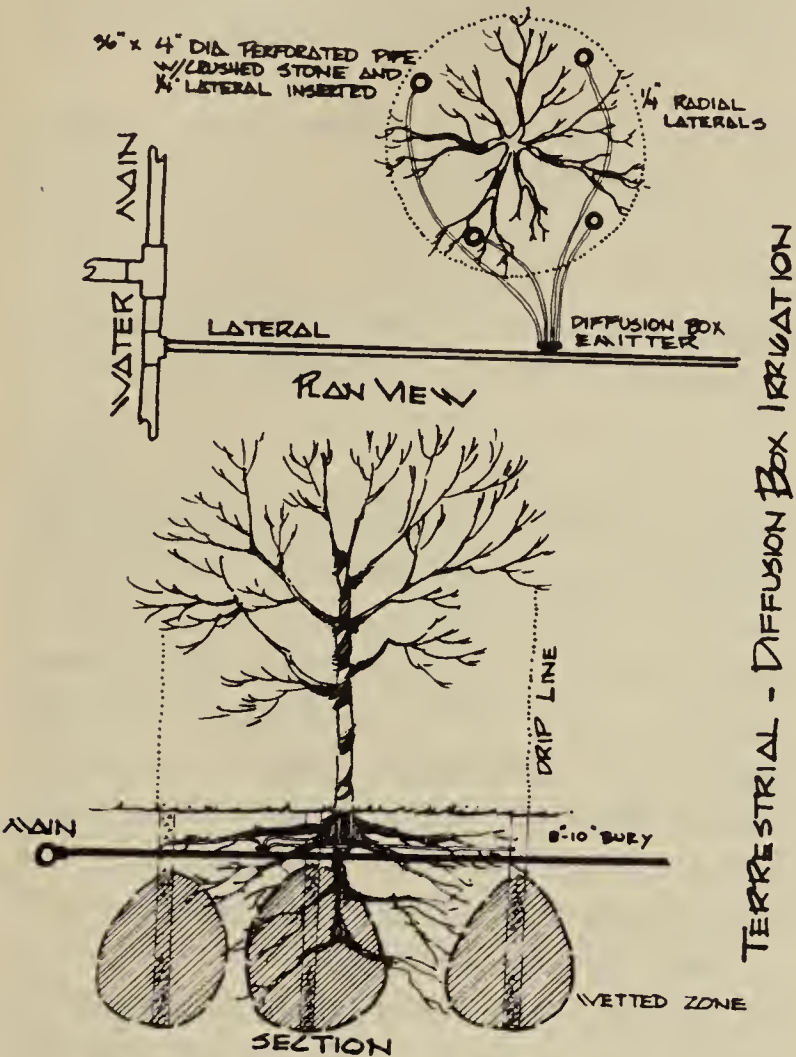
Drip Irrigation, or Trickle Irrigation as it is sometimes referred to, is a system of supplying filtered water (and fertilizer) directly into the soil. Elimination of spraying is achieved by allowing water to dissipate under low pressure in an exact pre-determined pattern. Water is carried to each plant through a pipe network then an outlet device sends water into the soil through an emitter. A small orifice in the emitter reduces line pressure to allow only a few gallons per hour discharge. After water leaves the emitter, it is distributed by normal movement through the soil profile. Less water is used because little if any water is exposed directly to the air. Water droplets are emitted intact as opposed to aerial spraying that breaks droplets into smaller, less effective drops and mist. Since water is applied directly at the base of each plant, instead of over a wide area, drip irrigation provides substantial savings on water bills. Additionally, the reduced water flow concurrently reduces weed growth between plants, since the distribution of the water is limited to only a few feet of surface area surrounding the plant. Anywhere from one to four or more emitters are placed around the plant as the line passes the plant. The purpose of increasing the number of emitters is to spread distribution of water around the base of larger plants. New plantings can be started with one emitter, and additional emitters added as the plant matures.

The water drips out of these emitters, literally drop by drop, onto the soil without disturbing the soil structure, so that the water can seep between soil particles. Once in the soil, the water moves by capillary action to the surrounding areas. Beneath each emitter, the water forms a wetted area that varies in form and size depending upon the soil characteristics. Generally, this area will be 2 - 4 feet in depth and 1 - 4 feet in radius. Application rates will vary according to plant uptakes and soil permeability but in all cases, water volumes required to irrigate will be greatly reduced as compared to conventional aerial spraying.

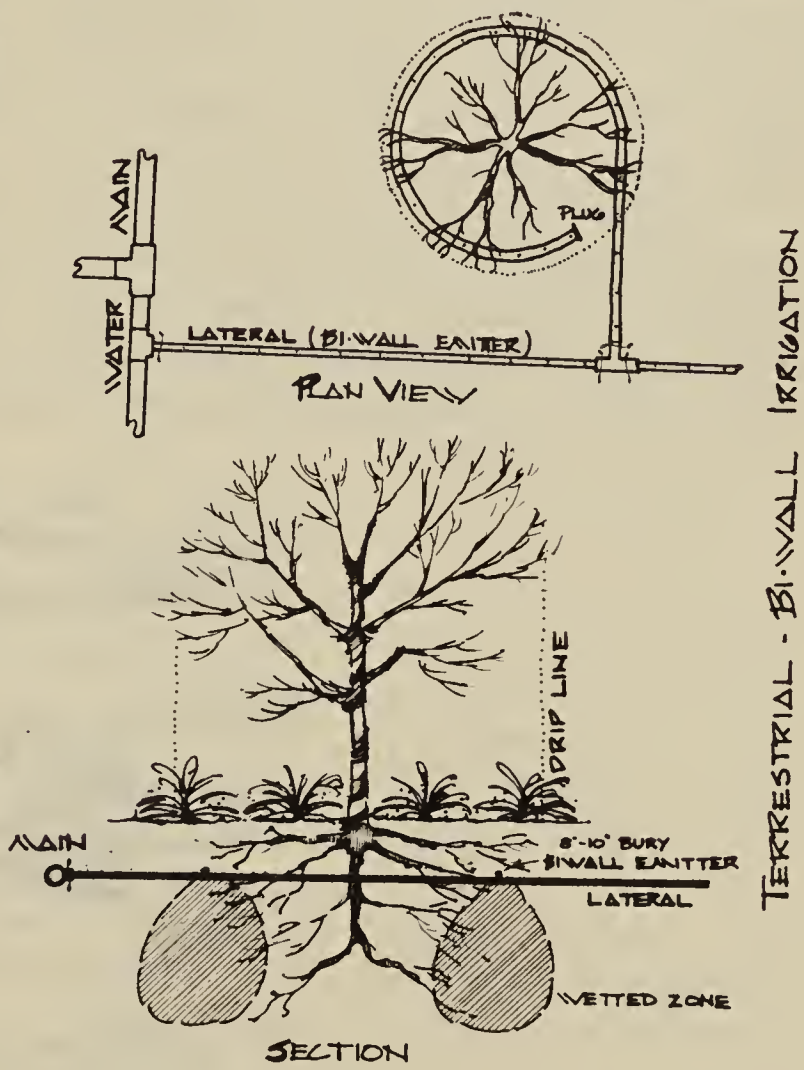
As early as 1860 experiments in controlled terrestrial irrigation were being performed in Germany. This early system used agricultural tile laid with open joints. In 1920, perforated pipe was introduced, thus allowing for better control of water emission. Not until the development of inexpensive, flexible plastic pipe did drip irrigation finally burgeon into a full scale irrigation technique. Since 1940, vast improvements in emitter design have allowed large-scale application of this type of irrigation in areas where water is extremely scarce. Today, drip irrigation is used in fields and orchards as well as greenhouses in many countries where water is extremely scarce.

Many types of drip irrigation systems exist and are currently stocked by many manufacturers. However, discussed here are two methods which can be implemented by the average homeowner. These systems can be placed in two categories as overland and terrestrial. First, in the overland type, we have simply a series of small diameter flexible lines approximating 1/2 inch in diameter with in-line or barbed emitters

(Figure 1) located adjacent to the plant to be irrigated. These emitters are literally laid on the surface of the ground as is the main line providing the water from the hose bib. Several hundred feet can be laid in one series with emitters along and adjacent to each plant. However, if esthetics or vandalism is to be taken into consideration then the design and installation must reflect these problems.



Terrestrial-Diffusion Box Irrigation



Terrestrial-Bi-wall Irrigation

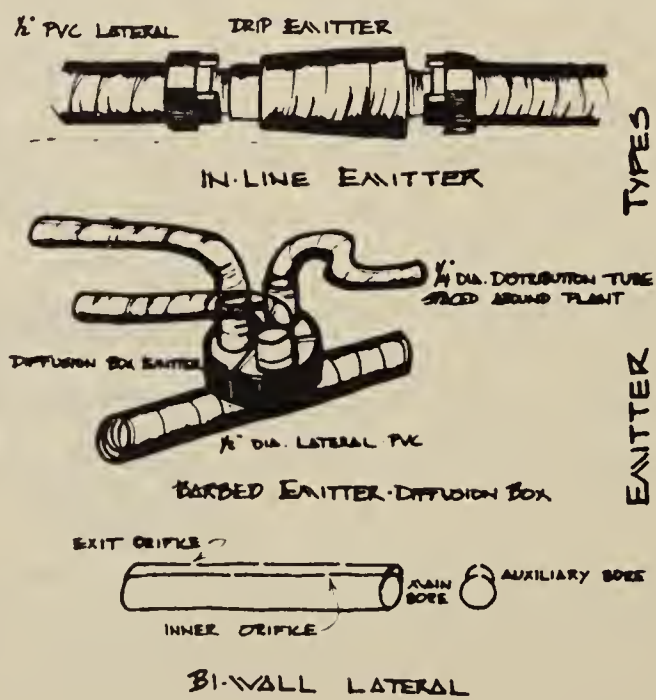
The terrestrial type of emitter system may prove a better long-term permanent type of system for these two very real considerations. Of course, the effort required to install a buried system is much greater, but the hidden aspects of this type of system must certainly be appealing. Again, the mainstay of this system is the 1/2 inch diameter polyvinyl chloride (PVC) tubing. Two general types of emitters are suited for this type of installation (Figure 3); however, soil conditions may prevent the use of the biwall type (heavy clays). This type of buried system does have its drawbacks; annual inspections and year-end drainage must be carefully planned during installation so no damage occurs to the system.

One type of emitter usable in the terrestrial system utilizes double wall tubing where the primary line has small openings to a smaller line attached above. This type can be easily laid around shrub borders and individual trees (Figure 3). Another type utilizes a central diffusion box from which one to six 1/4 inch lines radiate outward. These small diameter tubes can be strategically placed around the plant or along a shrub border in such a manner as to assure adequate irrigation (Figure 2) virtually maintenance free.

Drip irrigation offers potential benefits in the efficient use of water, plant response, engineering, economics, and maintenance. Water efficiency is attained by limiting direct evaporation — no movement of water drops through the air, no wetting of foliage, and no evaporation from the soil surface outside the wetted area. Furthermore, weed growth is inhibited and the non-beneficial consumption of water by weeds is greatly reduced. Properly designed and maintained, drip systems produce no runoff.

Plant response to drip irrigation appears to be somewhat superior to other systems of irrigation. Many times, greater crop yields and better quality have been obtained. A well managed system will effectively aerate soil, and a consistently low tension soil moisture can be attained. By minimizing the wetted land surfaces and plant foliage, reduction in insects, disease, and fungus can be achieved.

Cost of drip irrigation systems is substantially less than the solid-set conventional system. Additional emitters can easily be added to the system at any time. Since the material is primarily constructed of small diameter PVC lines and laterals, costs are very reasonable. Installation requires only care and a few hand tools to augment nearly every type of permanent conventional irrigation system.



Emitter Types

Bromeliad Collection

Honors Walter R. Smith

Andrew Pierce

Many of you already know of our limited collection of bromeliads through visits to the Conservatory and various displays in the Lobby Court, but to bring you more up to date and give you some more details, here are a few facts regarding the above collection, which was mentioned briefly in the *Green Thumb Newsletter* of September, 1977.

Certain groups of plants are fairly well represented in the Denver Botanic Gardens including iris and dahlias outside, cactus and orchids, especially the genera *Encyclia* and *Epipdendrum*, inside. A larger collection of a family group has never been really contemplated because an actual family group would be too large for our present facilities, and money is just not always available to secure specimens and provide housing.

It wasn't until recently that we heard of the possibility of obtaining such a collection as these bromeliads which seemed to fit the above criteria.

What are Bromeliads?

Many people know the pineapple, and others from the south-eastern states are familiar with Spanish moss, but to put them together in one family is not so easy. Plants, like people, vary immensely, and it is particularly noticeable within this very interesting family Bromeliaceae. All members of the pineapple family (Bromeliaceae) have certain basic characteristics in their flowers,

which are, of course, the identifying feature of all plants. Again it is not easy to relate the prickly foliage of the pineapple to the soft grey of the Spanish moss, but the flowers of both have only three petals and six stamens and a three-sectioned seed pod. This incredibly puts the family near that of Liliaceae in the evolution of time, as the lilies' basic structure is set on two whorls of three petals and six stamens. Many of the bromeliads have prickly leaves which are usually in a whorl, often forming a cup for the retention of rain water. Others, like *Tillandsia*, with soft grey foliage, absorb considerable moisture from the air itself. A great majority are epiphytes, clinging to trees or rocks (*saxicolous*) in their native habitats. Their home ranges from the southern states, with Spanish moss (*Tillandsia usneoides* L.), down through the Central Americas and neighboring islands and deep into South America. Some, such as *Puya*, even exist up into the snow levels of the Chilean Andes, but most others have a more tropical range. Their principal areas of nativity are in Mexico, Brazil, and the adjoining countries.

There are perhaps around 2,000 species in 48 genera with a great many often poorly recorded varieties and cultivars in the family. Here in Colorado, they generally have to have glass-house protection. With our very penetrating sun and low humidity, it is difficult to keep them outside in the

summer, and of course, none of them can be considered frost hardy though it would be fun to try with the genus *Puya*. With their increasing popularity and the relatively small size of some species, it is quite possible to grow them under artificial light conditions. This then gives you an idea of the family as a group and also of the feasibility of Denver Botanic Gardens having a well represented living collection.

Bromonia

Perhaps *Bromonia* is a colloquial title but most appropriate for the late Walter R. Smith's collections in his backyard greenhouses down in New Orleans. Mr. Smith, while a Federal government employee, somehow managed to travel and gather one of this country's most extensive collections of bromeliads. He traveled widely throughout the States with a burning desire to obtain an example of every living variegated bromeliad species and variety and was often in contact with the Fosters and Humels, other great collectors of the period. Not only did he correspond with avid growers in the United States but also with those in many a foreign country. You can see from his meticulous records the history of his plants and that of many others as well. He was one of the few men who dealt with commercial growers and hobbyists alike.

Mr. Smith, while not a founding member of the National Bromeliad Society, certainly had influence during its growth and also in the diversification of the New Orleans Society into the present five large groups. He wrote various articles for the journal and other publications, and at the same time built up a collection of library material which has also been donated by Mrs. Smith to our own library.

Why Denver Botanic Gardens?

Since Mr. Smith passed away, the collection had been looked after by his widow, Mrs. Miriam Smith, and she felt that it should be maintained intact as a memorial to her late husband. She had



Tillandsia stricta Soland

been unable to find an organization in New Orleans or Louisiana which had the ability to protect and keep such a collection, and this is where Denver Botanic Gardens came into the picture. A very good friend of the Gardens, Dr. Paul Earle, who is a bromeliad enthusiast, was working in New Orleans, heard of the possibility of the collection being moved, and followed it up. After a period of time, with various correspondence and visits by Dr. Earle, the matter was put before the Board, and Dr. Gambill was instructed to write Mrs. Smith as to the willingness of the Gardens to accept such a collection.

The next problem was the logistics of shipping such a precious group of plants. Various methods of packing were explored, and finally a trucker who ships vegetables and the like to New Orleans was employed to pick up the plants at a reasonable cost. Dr. Earle and I drove down to New Orleans with all the necessary paraphernalia for packing, and with the very kind help of the local Bromeliad Society, had the plants boxed before the trucker's arrival. The plants were packed individually in plastic sleeves and then packed tightly in the upright position before being sealed. Of course, we were concerned for their well being until they arrived in Denver, which was some two days later, but our fears were unfounded as they arrived in perfect condition.

They are New to Us

Many of the plants were new to us, and even some of the genera, e.g. *Hohenbergia*, *Pseudoanas*, and *Wittrockia*. Also, for the first time, were the hybrid genera of *Canmea*, *Neomea*, and *Quesmea*, which are crosses of *Canistrum*, *Neoregelia*, and *Quesnelia*, with *Aechmea*, respectively. There are extensive additions to our existing genera, *Aechmea*, *Billbergia*, *Guzmania*, *Neo-*

regelia, *Nidularium*, *Tillandsia*, and *Vriesea*. As mentioned earlier, Mr. Smith was particularly interested in variegations and the collection includes several original clones of hybrids made by various growers. To many, some of the plants may look perhaps somewhat uninspiring but don't let mother nature fool you. Underneath a common green there is a seasonal change of floral beauty as well as vivid changes of foliage. Bromeliads are not a family for one time viewing, but rather a family of unending interest, even though change is slow. Some of the flower bracts rival those of the poinsettia and leaf hues and variegations exceed those of the copper leaf.

Their Use and Extension

Already the Gardens are receiving offers of further donations to add to the collection, and at the same time visitors are starting to appear asking specifically to see the collection. In time, with additions, the Gardens can have an outstanding collection of national importance serving the needs of the horticulturist, grower, scientist, and botanist.

Can we be anything but thankful to Mrs. Miriam Smith and the late Walter R. Smith for giving Denver Botanic Gardens one of its most important plant gifts since its inception? Indeed, not only the Gardens but the city, its people, and ardent plant growers should be aware of their good fortune.

One of the projects being entertained by the Gardens' new fund drive is an extension to the west end of the Conservatory to house and put on public display the orchid and bromeliad collections. At present, the plants are being housed in the greenhouses that are off limits to the public, and it is only by the use of the Lobby Court that we have been able to show visitors some gems of the Walter R. Smith memorial collection.

Alaska 1977

Botanic Gardens Tour

Esther Witte

Alaska is a uniquely big and beautiful world, even to mountain-grown "OUTSIDERS" from Colorado.

Departure of the first Denver Botanic Gardens Alaska Tour was Thursday, July 21, 1977, on an overcast and soggy morning, Denver's first moisture in many weeks. With buoyant anticipation, 26 raincoated, boot-equipped, senior-rough-and-readies, named-tagged from Denver Botanic Gardens, embarked for 17 days of Northland exploration and high adventure. It was all-aboard on a gigantic 250-passenger Continental DC 10.

Almost immediately, Al Hess brought attention to his wife (Alma Jean) and to our contingent — of what appeared to be botanical scientists — by winning an In-Flight competition and a bottle of champagne for confessing to the hole in his sock. From this sporting beginning, it was established early in the trip that individuals brought together by an interest in plants produce a congenial group. Labor strikes and occasional travel inadequacies failed to uncover a bedeviling, inflexible complainer amongst us.

Without intending to do so, we exported Denver's rainstorm. Juneau welcomed us with low clouds and drizzle. We had glimpsed Mendenhall Glacier (15 miles to the northeast) on the descent into the Juneau airport but had otherwise been denied the impact of the gorgeous scenic setting of Alaska's

capital city. Our camera-laden party looked worried, knowing well the universal weather vagaries of 1977 and not encouraged by an airport bumper sticker "DON'T suntan — RUST in our beautiful SUNSHINE CITY." Alaska's 568,412 square miles stretch across four climate zones so we kept in mind that a prevailing weather pattern in one area was not likely to be general.

In addition to Juneau our itinerary would take us to another coastal city, Ketchikan. Both cities are located in the comparatively mild maritime climate zone which is influenced by the Japan Current. Because of the favorable growth conditions, the steep hillsides which confine homes and businesses to narrow shores of shipping channels are covered with spruce, hemlock, edible berries, wild roses, and a profusion of flowers. Land is dear and garden space limited, but artistic flair finds expression in different type fences, terraces, and window boxes loaded with happy plump pansies. Lush dark blue delphinium touched the eaves of moss-covered roofs in residential Juneau. Our English-born Pat Lanoha felt home again.

We needed raincoats for the next three days. This was not an unexpected weather development since our expedition was exploring Glacier Bay National Monument, a natural area whose outstanding features are dependent on heavy precipitation. The program included a six-mile conducted nature walk to Bartlett Inlet through an eerie,



Botanists Confer — Independence Mine Tundra

Left to Right: Harold Kirchen, Doris Dearborn (behind her husband), Dr. Curtis Dearborn, Pat Lanoha, Lucian Long, Betty Bowman, Dr. William Gambill.

dripping, rain forest patrolled by brown bear and a day-long wet cruise of Glacier Bay on a small motor launch. Imie and Fred Harper had elected to do the Glacier Bay trip a day ahead of the rest of us so had advice for the cold-blooded: "Wear everything in your suitcase." Harold Kirchen, Montana-bred geologist, demonstrated the art of achieving Arctic-toastiness. He enjoyed the outside deck all day in two pairs of pants, a shirt and a woolen sweater topped with two jackets, plus woolen inner-soles in his rubber boots.

The photographic subject matter was sensational; hump-back whales to both port and starboard, hair seal, island bird sanctuaries, hopeful salmon-fishermen, pontooned planes, and McBride Glacier calving a huge hunk at precisely the right time.

The next air hop deposited us in Anchorage at 62 degrees N. latitude. It was to be our base camp for side trips to the Matanuska Valley and the Kenai

Peninsula. The skies had cleared and during the hour-flight we looked down upon the rugged beauty of the St. Elias and Chugach Mountains. To approach the airport the plane cut a wide arc in front of spectacular mountains surrounding the low alluvial plain on which the sprawling city of Anchorage lies. It was low tide in the Knik Arm and Turnagain Arm of the upper Cook Inlet, the clustered buildings of the central business district appeared to be stranded on a peninsula ringed by a vast mud flat. The whopper 30 foot tides which cause the mud flats, plus frequent earth tremors, enliven the Anchorage daily news. We visited the three acre garden of the Strutz family near central Anchorage and walked up the ten foot difference in land contour which resulted from the 1964 earthquake.

The day supreme for 10x-lens-botanists was spent on the alpine tundra high above the rich agricultural Matanuska Valley with Dr. Curtis Dearborn and his wife, Doris.

After touring the Palmer Experimental Station where Dr. Dearborn is chief horticulturist, we sampled Alaskan delicacies in Doris' kitchen — home-baked bread oozing fresh creamery butter, topped with jelly. Nagoonberry (*Rubus arcticus* L.) was the favorite choice.

With the Dearborns as guides, we drove up the lovely valley of the Little Susitna River toward Hatcher Pass and the Independence Mine, making numerous stops enroute to botanize the roadside. To Colorado residents most genera were familiar; what we weren't used to seeing were the lush, grassy timberline meadows, where you could stand in shoulder-high cow parsnip (*Heracleum lanatum* Michx.), goatsbeard (*Aruncus syvester* Kostel), spirea (*Spirea beauverdiana* Schneid.), Arctic lupine (*Lupinus arcticus* S. Wats., incl. *L. nootkantensis* Donn.) and monkshood (*Aconitum delphinifolium* D.C.). During July and August 100 species of flowers bloom in the area.

The deep-blue, yellow-eyed forget-me-not (*Myosotis alpestris* F. W. Schmidt) is the official state flower of Alaska, but everywhere, from spring through fall, fireweed makes the more unforgettable display of color. These bold and striking plants fringe the highways, lakes, and streams and carpet meadows and open areas with flamboyant hues of magenta and rose-purple. It spreads by invading underground rootstocks and even thrives in permafrost which makes it one of Alaska's most loved wild flowers. Of the numerous species *Epilobium angustifolium* L. and *E. latifolium* F. W. Schmidt (*Chamaenerion angustifolium* Schur. and *C. latifolium* Sweet.) are the most common. Fireweed is a completely edible plant and a joy around the seasons. By fall it often attains a height of eight feet and the brilliant red of its foliage continues to dominate the landscape.

Ask an Alaskan where he likes to vacation. His answer will likely be the Kenai Peninsula. For many years a mecca for big game hunters and fishermen, its beautiful scenery, salmon streams, and dense forests are today easily reached from Anchorage by paved highway. Our three-day safari included overnight stays at the oil-boom town of Kenai (sixth largest city in Alaska) and at Homer, the artists' colony on blue Kachemak Bay at the mouth of Cook Inlet.

We made photography stops at Ninilchik with its quaint onion-domed church and at the picturesque village of Nikolaevsk where all residents speak Russian. The cultural and historical ties which the United States has acquired with Russia, as a consequence of Alaska statehood, introduced a subject new to our thinking.

On Kenai and elsewhere, Alaskan adventures-in-good-eating were often wayside cafes with the appointments of truck stops. At first glance menus generated grumbling — \$2.00 for a piece of pie and \$.65 for coffee. But after the home-style cooks served a John Bunyan slice of pie which actually did melt in the mouth, the grumblers paid and smiled.

The spawning salmon were having a disastrous season throughout Alaska. Swollen rivers and smaller streams were still carrying a torrential runoff of water in August, the result of heavy winter snowfall and an unusually hot summer. We had witnessed the salmon's losing struggle at the Salmon River near Mendenhall Glacier on Kenai Peninsula. Later we hiked three miles into an important spawning area at Russian River Falls. Thousands of exhausted and dying fish churned the water in the pools at the foot of the roaring cascade. Until their funds were exhausted the U.S. Forest Service carried 9000 fish by helicopter to spawning waters above

these falls. According to Forest Service estimates only 4500 fish had been able to ascend the falls on their own.

What is a "moose enclosure"? No, it isn't. It is a 40' x 40' fenced-in clump of willow bushes. Willow is the moose's favorite food and the high wire fence protects the natural willow growth from browsing moose. The enclosure is a device used in range management by the U.S. Forest Service; we saw them in McKinley Park.

Mt. McKinley is so frequently encased in clouds, a mere ten percent of National Park visitors are lucky enough to see it. With the hope of increasing our chances, we rolled out of warm bunks on a cold drizzling morning at 2:30 a.m. and caught the early bus into the national park from McKinley Park Station. With us, as guest guide and lecturer, was Dr. James Mitchell, professor of Botany at the University of Alaska. He knows the woods of Mt. McKinley and the location of its game trails from many years of back-packing in the park. We weren't having much success distinguishing Mt. McKinley from the clouds and had turned our attention to botanizing the tundra around Stony Hill at Milepost 60, when it suddenly happened. Both the north and south peaks of "Denali", the High One, emerged. It was Sunday, July 31, 1977.

When our train pulled into the Fairbanks station it was 87 degrees; what we had on our minds was air-conditioning and hot showers. Hot, dry weather had been plaguing south-central Alaska for several days; forest fires were raging over half a million acres. The temperature in Fairbanks had soared to 90 degrees a couple of days before our arrival; it was a contradiction to be so uncomfortably warm at 65 degrees N. Lat. It was a short overnight stop in Fairbanks where they were enjoying the season of 21 hours of daylight. By 11:00 p.m. it had cooled to 70 degrees

F. and was dark enough for us to go to sleep.

The one hour and ten minute flight from Fairbanks to Whitehorse, Yukon Territory, parallels the Alaska Range. It was — according to the pilot — a rare morning, not a cloud in the sky. To the right of the plane, 100 miles away, Mt. McKinley soared unobstructed into the blue. Below the plane the Alaska Highway and the recently opened oil pipeline (oil arrived at the Valdez terminus on July 29th) were two white ribbons in the broad fertile valley of the Tanana River, the largest tributary of the Yukon. We were alerted to watch for the Canada-United States border. It sounded like a joke, but wasn't. The border is a treeless swath, 75 feet in width, which extends 700 miles due north and south along the 141st meridian west from the St. Elias Mountains to the Arctic Ocean.

We liked Whitehorse. The Denver Botanic Gardens Stampede swung their packs aboard the Yukon River launch, M. V. Schwatka, the afternoon we arrived, and shoved off for a twelve mile cruise up-river through the infamous Miles Canyon, a stretch of water which brought grief and death to many gold rush Klondikers. The treacherous rapids are now beneath Lake Schwatka, a hydro-electric project, but it wasn't difficult to imagine the dangers encountered in the narrow canyon.

Whitehorse at night rocked with stompin' stampede and electric guitars. The "Frantic Follies" monopolized the tourists and treated them to 'high-kickin' can-can girls and hilarious dramatizations of Robert Service's "Cremation of Sam McGee" and "The Blue Ice Worm." Shortly after midnight, the local night-lifers staged a novel competition in the popular Klondike Inn Tavern — a bra-less "Wet T-shirt Contest". The winner was awarded the T-shirt she was wearing.

Our predecessors, on foot or by mule, had come up the "Trail of 98" from Skagway to Whitehorse. We descended the steep gradients of the trail in a railway coach of the narrow-gauge White Pass-Yukon Route. It was a sunny day and an interesting all-day trip.

We entered sea-level Skagway by its back-door. It was here in the last days of July 1897 that the first boatloads of stampeders landed. From a floating boom-town population of 20,000, Skagway is today a year-round port of 750 residents. From the railway station, bulging with young back-packers eager to tackle the Chilkoot Trail, we could see the blue and white funnels of the luxury French cruise ship Renaissance, waiting to take aboard its Skagway passengers. Sharing the decks with

passengers from New York, Los Angeles, and Paris, we watched Skagway become a speck of land at the head of the Taiya Inlet.

For the next four days we cruised the Inland Passage and attempted to keep up with the French cuisine and the planned cruise activities. The day spent in magnificent Glacier Bay was sunny and made to order for photographers. The ship called at Ketchikan and on August 7th arrived at Vancouver, B.C.

What happened to us in Vancouver was not on our itinerary. All flights were grounded; the air traffic controllers had called a strike. Getting out of Canada by bus wasn't easy, but we made it. It was one of those unexpected developments which separate the travelers from the tourists.



Russian Church, Ninilchik, Kenai Peninsula

Russian Botanists Visit

William H. Anderson, Jr.

Three Soviet Russian botanists spent August 10 and 11 in Denver as guests of the Denver Botanic Gardens. Their stay in Denver was part of a six week tour of selected areas in the United States.

In 1976, Russia and the United States signed an agreement for an exchange of information and material and for visits of botanists from one country to the other.

Dr. Valery I. Nekrasov, Chief, Department of Exchange and Seed Investigation, Main Botanical Garden, Moscow, Dr. Lilian S. Plotnikova, Senior Scientist, Main Botanical Garden, Moscow, and Dr. Igor V. Belolipov, Senior Scientist, Tashkent Botanical Garden, Uzbek Academy of Science were the Soviet scientists visiting the United States in the summer of 1977.

Upon the return of the Russian scientists to their country, three American Botanists visited in Russia. The three Americans were: Dr. Theodore J. Crovello, University of Notre Dame, Mr. Robert Hebb, Cary Arboretum of the New York Botanical Garden, and Dr. Dieter Wilkins, Colorado State University.

1977 is the second year of what is

planned to be a 10 year exchange program. The agreement between the two countries calls for the collection, protection, and introduction of rare and endangered species. Both nations have agreed to exchange seeds or other materials of species native to each country for experimental cultivation. Also, they agreed to develop specific programs of cultivation of rare and other species of plants native in each country which may be useful in meeting human needs.

While in Denver, the visiting botanists were taken on a tour of the Front Range close to Denver to give them a chance to observe and collect in various life zones. Glenn Parks conducted the tour and the Russians returned to Denver with bulging plant presses. After luncheon at Botanic House, they left Denver to return to Russia.

Dr. William G. Gambill, Jr., director of Denver Botanic Gardens, in commenting on the exchange of scientists and the strong dedication to the preservation of endangered species evident in the program said that it would be hard to over-estimate the real value of such face to face cooperation.



Left to right: Dr. Valery I. Nekrasov, Dr. William G. Gambill, Jr., Dr. Lilian S. Plotnikova, Dr. Igor V. Belolipov, Mr. Glenn Park.

Exotics of COLORADO

Acer platanoides

Norway Maple

Helen Marsh Zeiner

Norway maple, *Acer platanoides* L., is a common tree in the Denver area. As its common name indicates, *Acer platanoides* is native to Norway. However, it is not limited to Norway — its natural range extends as far south as Switzerland. Norway maple is extensively planted as a shade or street tree in the eastern United States and along the west coast. It has also proven to be very useful at lower elevations in the Rocky Mountain area where it can be irrigated. It is a recommended tree for Denver.

Norway maple has wide spreading branches above a short trunk resulting in a low, round, compact head. It provides dense shade.

The five-lobed opposite leaves are dark green above, lighter green beneath. The leaves are sometimes mistaken for those of sugar maple, *Acer saccharum* Marsh., but they are firmer, broader, and darker in color. When the leaf stalk is broken, it exudes a milky juice. This is a good distinguishing feature for Norway maple. In the fall, the leaves turn yellow.

The bark is also distinct from that of sugar maple. It is tightly furrowed in contrast to the scaly bark of sugar maple.

In the spring, Norway maple is densely covered with clusters of chartreuse flowers, larger and more showy than the usual maple flower. Staminate flowers, pistillate flowers, and perfect flowers can all be found in the same cluster. The flowers are fully developed by the time the leaves unfold.

Maples are characterized by paired samaras (indehiscent dry winged fruits) sometimes called keys. Different positions of the wings distinguish the various species. *Acer platanoides* has nearly horizontally spreading wings, quite different from sugar maple in which the wings are nearly parallel. Although the samaras are full grown in late spring, the seed does not mature until fall and the pale green samaras can be seen all summer.

Norway maple is easily distinguished in winter by its furrowed bark and large, reddish brown or purplish brown buds in pairs. When a bud is broken off, milky juice will ooze from the wound.

Norway maple is a hardy, disease resistant tree that tolerates city conditions. It is shallow rooted and in this area needs irrigation in dry open winters.

Thirty to 60 feet at maturity is its usual height, although Norway maple can reach a height of 100 feet.

Acer platanoides has been cultivated for many, many years, and a number of horticultural varieties have been developed. One common in this area is Schwedler maple, *Acer platanoides schwedleri* Nichols. When its leaves first appear they are red, changing to purplish red and finally to dark purplish green. Schwedler maple has been cultivated since 1870.

The genus name *Acer* is the old classical name for maples. The genus

name of the sycamore, *Platanus*, and *platanoides* are both from a Greek root meaning broad. *Platanoides* means "like *Platanus*" and refers to the broad, sycamore-like leaf of Norway maple.

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Leaves and fruit — Norway maple

DROUGHT GARDENING IN COLORADO

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Community Gardens

William H. Anderson, Jr.

Hundreds of Denver men, women, and children grew scores of bushels of vegetables and flowers in 1977 under the auspices of two organizations — the Denver Mayor's Neighborhood Garden Project and the Denver Botanic Gardens, Inc. The Botanic Gardens program has been carried on for 18 years; the Mayor's program was 5 years old in 1977.

The Neighborhood Garden Project was a citywide program involving 85 to 100 gardens located in every area of the city except the central business district.

Typically, the neighborhood gardeners planted an area of two or three city lots 50-75 x 125 feet. These were divided into plots each cultivated by a person or by a family. Crews of workmen from the city rototilled 52 garden sites. The smallest plot of these was 10' by 10', two were about 1½ acres each. The city crews estimated that between 20 and 25 acres were actually cultivated during the summer.

The city administration provided seeds in many instances. Water was made available in a number of ways. In some spots, fire hydrants were tapped for low pressure hoses. In other locations hoses were run from houses adjacent to the gardens. Elementary school children in the Denver Public Schools system grew tomato plants in tin cans as part of an educational experience and turned the plants over to the neighborhood garden project for setting out in the gardens.

By June, 85 or more gardens were being cultivated under the auspices of the Mayor's project. Some were sponsored by churches, some by people living in apartment houses or condominiums, and others by people in a neighborhood. No attempt was made to keep track of the number of people involved, but certainly there were hundreds.

Crops grown in most gardens included corn, squash of many varieties, bush and pole beans, tomatoes, peppers, chard, kohlrabi, lettuce, onions, and carrots. In nearly every garden cornstalks and poles supporting pole beans towered above the rest of the garden. Since harvesting went on all summer no attempt was made to estimate the quantity of food produced, but it was undoubtedly substantial.

1977 was a good year for insects and consequently many gardens suffered from such pests as spider mites, aphids, and psyllids, but people in most gardens reported pretty good harvests. Vandalism, as always, was something of a problem in city gardens but damage was reported to be minor in most places. People in many gardens learned to plant corn and pole beans on the edges of their plots. By mid-July, these tall plants tended to hide the lower vegetables in the center of the plot and apparently reduced damage by vandals.

The culminating activity of the Mayor's Garden Project was the Senior Citizens' Harvest Display, Sept. 7 and 8

COMMUNITY GARDENS





in the United Bank of Denver Plaza. Here in typical county fair style display tables were loaded with prize-worthy products. Hundreds of passers-by had a chance to see the exhibits and talk with the exhibitors.

The 18 year old program of the Denver Botanic Gardens was centered at three locations — one at Barrett School, one at the Children's Garden, and the third at the York Street Garden. At the Barrett School garden Mrs. Judy de Croce supervised the program. Here there were 44 10' x 10' plots for the use of school children and an adult community garden.

The Children's Garden, across York Street from the Conservatory, had 60 10' x 10' plots cultivated by children of school age. Across the street, north of the library, 35 10' x 15' plots were located, 15 used by teenagers and 20 by adults. John Brett supervised activities at these two locations.

Crops grown in the Denver Botanic Garden plots were about the same as in the community gardens. Mr. Brett and Mrs. de Croce reported some difficulty with insect pests, a little vandalism, and a continual fight with weeds.

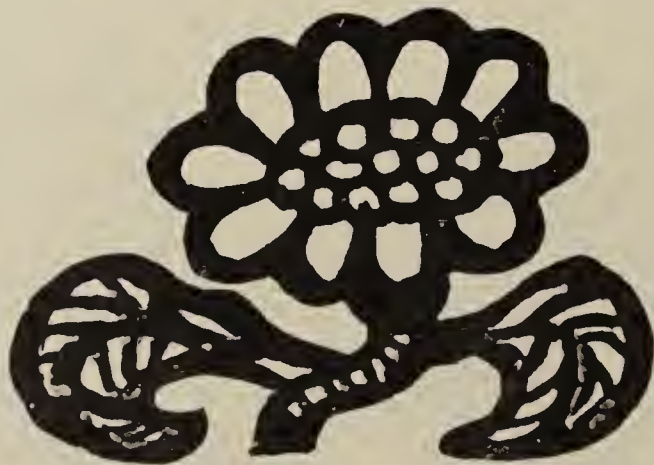
Graduation time for the Children's Garden dirt farmers came on September 10. More than 40 youngsters received certificates and potted plants in a ceremony at the Horticulture Hall at which Ms. Beverly Nilsen and Mr. Lee Schwade, over-all supervisors for the Denver Botanic Gardens, presided. Dr. William G. Gambill, Jr., Director of the Gardens, praised the participants for their interest and perseverance.

As this writer drove around the city during July and August, he visited many of the gardens — all three of the Denver Botanic Gardens program and 15 or 20 of the Mayor's Project. He could not help but notice how many gardens were growing in back yards. The existence of the planned and supervised program

undoubtedly encouraged hundreds of citizens to cultivate green thumbs.

People who want to take part, or have their children take part in the 1978 garden program should plan early. A telephone call to Mrs. Teddie Nead in the Manager of Revenue's office will put your name on the list of sites for cultivation, water, and seeds. At the Denver Botanic Gardens Ms. Nilsen or Mr. Schwade will be able to supply information about the Botanic Garden program. Mr. Herb Gundell, County Extension Agent, office in Washington Park, provides useful information about varieties of vegetables to grow, pest control, and watering and cultivation.

This writer wants to express appreciation to Mrs. Teddie Nead, in the office of the Manager of Revenue, Mr. Lou LaPerrier, Executive Director, Denver Housing Authority, and Mr. Don Martinez, Denver Housing Authority, for help and courtesy, including a half-day tour of many of the gardens in the Mayor's Community Garden Project. Ms. Beverly Nilsen, Botanist-Horticulturist, and Mr. Lee Schwade, Botanist-Horticulturist, Denver Botanic Gardens, were helpful as were Mrs. Judy de Croce and Mr. John Brett.



INDEX – ANNUAL REPORT for 1976

Board of Trustees	p. 2
Chatfield Arboretum	p. 23
Denver Officials	Inside Front Cover
Director's Report	p. 9
Construction & Development of Physical Facilities, p. 9; Property Acquisition, p. 11; Plantings & Acquisitions, p. 11; Seed Exchange, p. 14; Lobby Court Display, p. 14; Plant Give-away, p. 15; Plant Sale, p. 15; Children's & Youth Gardens, p. 16; Education Program, p. 16; Use of Facilities, p. 18; Publications, p. 18; Helen Fowler Library, p. 18; "Doctor Green", p. 19; Kathryn Kalmbach Herbarium, p. 19; Micology Laboratory & Herbarium, p. 20; Student Intern Program, p. 21; Trip to Great Britain, p. 21; Personnel, p. 22.	
Financial Statement	p. 26
Memorial Gifts	p. 27
Picture Credits	Inside Back Cover
President's Report	p. 6
Staff	p. 4, 5
Standing Committees	p. 29 ff.
Volunteers	p. 28 ff.

SUBJECT INDEX 1977

BOOKS

- Book Review, *Garden Meditations*,** BEP, Fall, p. 92
- Book Review, *Greenhouse Catalog of Catalogs*,** Paul Lapidus, Ed., Solange Gignac, Fall, p. 98
- Book Review, *The Illustrated Flower*,** by Seymour Chwast & Emily Blair, Solange Gignac, Fall, p. 98
- Book Review, *Rocky Mountain Flora*** by William A. Weber, William G. Gambill, Jr., Summer, p. 63
- Book Review, *Shrubs and Trees of the Southwest*,** by Francis H. Elmore and Jeanne R. Janish, Moras L. Shubert, Fall, p. 97

BOTANISTS

- Cockerell of Colorado** Joseph A. Schufle, Summer p. 58
- Aven Nelson—Pioneer Botanist,** Ruth Ashton Nelson, Spring, p. 29
- Frances Ramaley, Mountain Botanist,** David Ramaley, Fall, p. 86
- Russian Botanists Visit,** William H. Anderson, Jr., Winter, p. 123

BROMELIADS

- Bromeliad Collection Honors** Walter R. Smith, Andrew Pierce, Winter, p. 115
- Bromeliads: The Undiscovered Houseplants,** Lawrence Mason, Jr., Spring, p. 23

DENVER BOTANIC GARDENS

- Botanic Gardens Tour—Alaska,** Esther Witte, Winter, p. 118
- Fund Campaign for Progress,** Fall, p. 66

DROUGHT

- Drought Gardening in Colorado,** Mary Lederer, Winter, p. 126
- How Long This Drought?** Walter Orr Roberts, Winter, p. 109
- Understanding a Bad Drought,** James R. Feucht, Winter, p. 102

EXOTICS OF COLORADO

- Acer platanoides*, Norway Maple,** Helen Marsh Zeiner, Winter, p. 124
- Mullein — *Verbascum thapsus*,** Helen Marsh Zeiner, Fall, p. 95
- Musk Thistle — *Carduus nutans*,** Helen Marsh Zeiner, Summer, p. 56
- Sycamore — *Platanus occidentales*,** Helen Marsh Zeiner, Spring, p. 25

FOCUS ON

- Caryota mitis*,** Peg Hayward, Fall, p. 93
- Cycas revoluta*,** Peg Hayward, Summer, p. 54

GARDENS

- Community Gardens,** William H. Anderson, Jr., Winter, p. 127
- Drip Irrigation in Home Gardens,** William C. Laubner, Winter, p. 112
- Drought Gardening in Colorado,** Mary Lederer, Winter, p. 126
- Happiness is—A Rock Garden,** John G. Worman, Spring, p. 7
- High Altitude Vegetable Gardens,** W. B. Pings, Summer, p. 34
- Rhododendrons Will Grow in Colorado,** Panayoti Callas & Ray Radebaugh, Spring, p. 2
- Roadside Gardens,** Joanne S. Orr, Fall, p. 83
- Small Fruits in High Altitude Gardens,** W. B. Pings, Fall, p. 75
- Weather Vanes as Garden Ornaments,** Lorraine Marshall Burgess, Spring, p. 27

HISTORY

- Cemetery to Conservatory, Part IV, Calvary Cemetery,** Louisa Ward Arps, Fall, p. 68
- Cemetery to Conservatory, Part III, Cheesman Park *Redivivus*,** Louisa Ward Arps, Summer, p. 45

HOUSEPLANTS

Bromeliads: The Undiscovered Houseplants, Lawrence Mason, Jr., Spring, p. 23

INDICES

Annual Report, 1976, Winter, p. 131
Subject Index 1977, Winter, p. 131
Author Index 1977, Winter, p. 132

IRRIGATION

Drip Irrigation in Home Gardens, William C. Laubner, Winter, p. 112

MEMORIALS

"In Happy Memory", Josephine O. Robertson, Summer, p. 42
In Memoriam — Dr. Robert Stearns, Margaret Eppich Honnen, Fall, p. 99

NINTH STREET GARDENS

Self-Guided Tour in 9th Street Gardens, David Luebbers, Spring, p. 11

RHODODENDRONS

Rhododendrons Will Grow in Colorado, Panayoti Callas & Ray Radebaugh, Spring, p. 2

TREES AND SHRUBS

Acer platanoides, Norway Maple, Helen Marsh Zeiner, Winter, p. 124
Cotoneaster, Chris G. Moritz, Summer, p. 43
Versatile Viburnums, Jane Silverstein Ries, Spring, p. 9

AUTHOR INDEX 1977

Author	Page(s)
Anderson, William H., Jr.	123, 127
Arps, Louisa Ward	45, 68
B.E.P.	92
Burgess, Lorraine Marshall	27
Callas, Panayoti Peter	2
Feucht, James R.	102
Gambill, William G., Jr.	63
Gignac, Solange	98
Hayward, Peg	54, 93
Laubner, William C.	112
Lederer, Mary	126
Luebbers, Dave	11
Mason, Lawrence, Jr.	23
Moritz, Chris G.	43
Nelson, Ruth Ashton	29
Orr, Joanne S.	83
Pierce, Andrew	115
Pings, W. B.	34, 75
Radebaugh, Ray	2
Ramaley, David	86
Ries, Jane Silverstein	9
Roberts, Walter Orr	109
Robertson, Josephine O.	42
Schufle, Joseph A.	58
Shubert, Moras L.	97
Witte, Esther	118
Worman, John G.	7
Zeiner, Helen Marsh	25, 56, 95, 124



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Schoolhouse—Chatfield Arboretum.

Denver Botanic Gardens maintains a collection of living plants, both native and exotic, for the purpose of acquiring and spreading botanical and horticultural knowledge.

DENVER
BOTANIC
GARDENS

ANNUAL REPORT FOR 1977

TO FULFILL A PROMISE



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COVER

The Conservatory
from the Herb Garden

ANNUAL REPORT FOR 1977

Prepared and Published by the
Editorial Committee
and
Denver Botanic Gardens Staff

William H. Anderson, Jr., Ed. D.
Gilberta T. Anderson
Editors



Main Entrance — Conservatory

DENVER BOTANIC GARDENS 1977

CONTENTS

Denver Officials	Inside Cover	"Dr. Green"	17
Board of Trustees	2, 3	Kathryn Kalmbach	
Staff	4, 5	Herbarium	17
President's Report	6	Mycology Laboratory and	
Director's Report	9	Herbarium	18
Construction and Development		Alaska Trip	19
of Physical Facilities	9	Special Events	19
Plantings and Acquisitions	10	Community Services Increasing	20
Flower Displays	12	Financial Statement	23
Plant Give-Away	13	Memorial Gifts	24
Plant Sale	14	The Volunteers	25
Seed Exchange	14	The Associates of Denver	
Children's, Youths', and Adults'		Botanical Gardens	25
Gardens	14	Around the Seasons Club	26
Education Program	14	The Denver Botanic	
Student Intern Program	15	Gardens Guild	27
Use of Facilities	15	The Garden Club of Denver	27
Publications	16	Standing Committees	28-31
Helen Fowler Library	17	Information for Contributors	32

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Plant Sale



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Pergola View



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The Herb Garden in Winter



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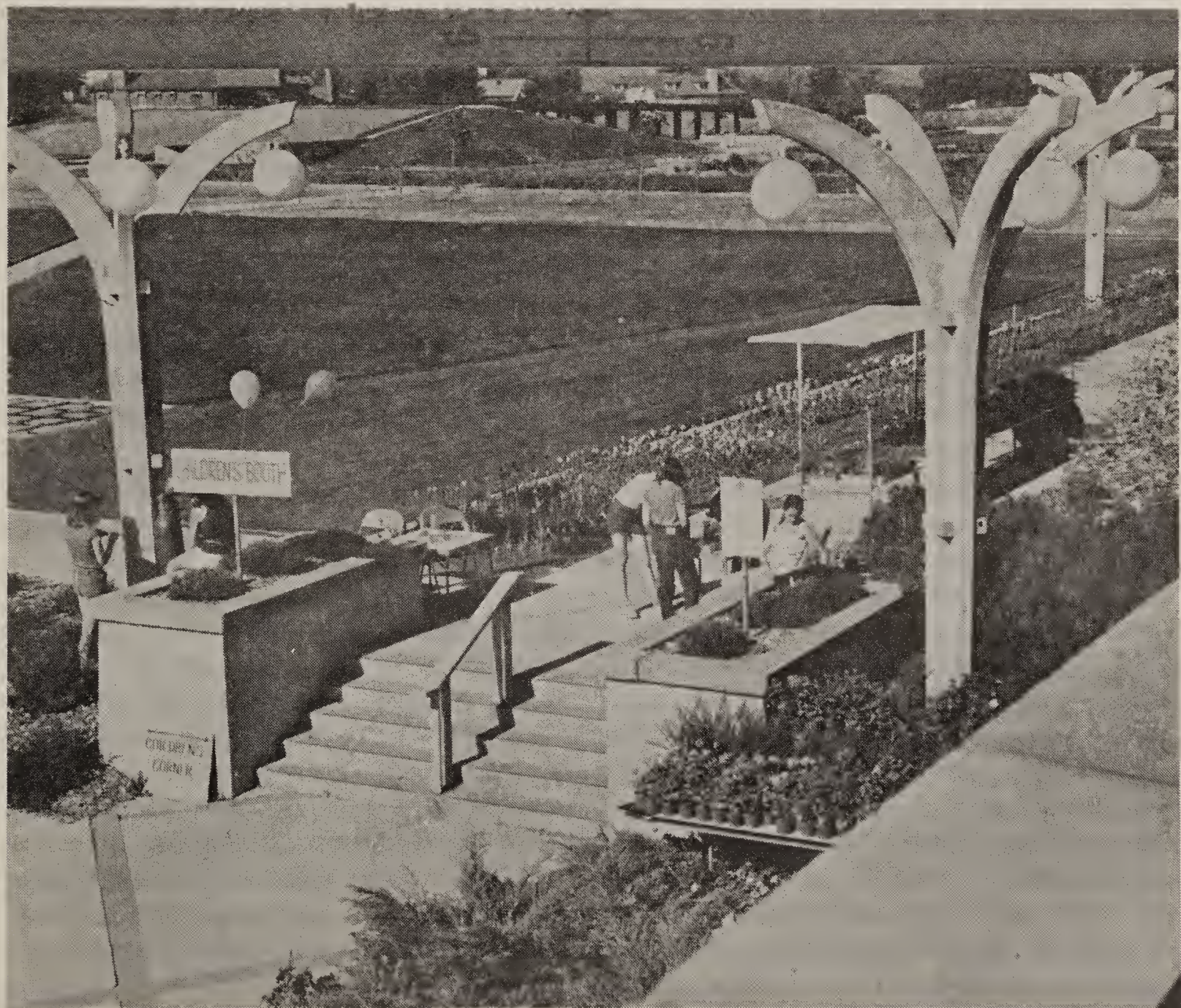
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*Left before end of 1977

Plant Sale — Before the Rush



DENVER BOTANIC GARDENS
1977

PRESIDENT'S REPORT

Nineteen hundred seventy-seven has been an outstanding year in the history of Denver Botanic Gardens. It has been marked by a recognition by the Board of Trustees that a number of important projects needed to be done and that it would be necessary to go to the public for the funds to make them possible. As a result the largest fund raising campaign in the history of the Gardens was mounted and at the time of this writing is approaching what promises to be a successful conclusion. Details of this important effort are given below following a report of a number of official items.

There was a number of changes in the make-up of our Board of Trustees. We note with sadness the loss of two of our Life Trustees, Mrs. Ed H. ("Marnie") Honnen and Dr. Robert L. Stearns, both of whom served the Gardens long and well almost from the beginning. We shall miss them immensely as associates, but their enthusiasm and inspiration will rest with us for many years. Changes which occurred at the annual meeting of the Board on January 24, 1978 included the election of Mrs. George H. Garrey as a Life Trustee. Retiring from the Board were: Mrs. John Brooks, Jr., Mr. O. Ben Haley, Jr., Mr. Alexander L. Kirkpatrick, Mr. James C. Owen, Jr., and Mr. Kenneth G. Wilmore. They have all been effective and valuable members of the Board for a number of years, and we are very grateful to them for their contribution. Newly elected at that meeting were: Mrs. Joseph (Holly) Coors, Mrs. William C. (Elaine) Jackson, Mrs. Thomas E. (Bea) Taplin, Mrs. James J. (Betsy) Tracy, Jr., and Mr. Don Elliott. We look forward to their joining us in this important public endeavor.

We regret that the Assistant Director, Glenn Park, recently resigned his post to enter business in California. We are grateful to him for the marked progress which has occurred during his tenure.

Our membership reached a new high of 3,088 as of year end. This is only a small increase over last year, and means are under study to acquaint more persons with the purposes and advantages of membership. As a member you can be very instrumental in enlisting the support of new members.

The attendance recorded at our main gate also reached a new high of 294,000, a 7% increase over last year. This is indicative of growing interest in the Gardens, and we hope that this can be translated into membership support in time.

As an agency of the City and County of Denver, The Gardens receives a major portion of its operating expenses from City funds. The allocation for 1977 was \$529,000. A citywide policy of budgetary reduction for the year, on the average approximately 16%, dictated a serious reduction of personnel at a time when our expanding program was calling for additions in order to achieve desirable standards of maintenance, as well as to carry out planned improvements. Expenditures for supplies also were curtailed under this budget or required the use of privately raised funds which otherwise could have been used for capital improvements. The latter, of course, are the responsibility of the citizen Board of Trustees which has endeavored to "hold the line" to the greatest extent possible and conform to the spirit of the City's conservative budget. Programs requiring capital expenditure or additional personnel have been avoided to a great extent during the year.

The operating financial statement of Denver Botanic Gardens, Inc., as distinguished from the City provided funds, reflects receipts of \$185,613. Larger items were: public contributions of \$43,062, plant sale proceeds of \$77,362, and memberships of \$44,042. Major disbursements reported in this statement were: plant sale expense, \$51,483, grounds expense, \$37,953, Chatfield Arboretum, \$35,967, and general operations, \$24,061. Disbursements exceeded receipts by \$49,540, which reflects the need to supplement City provided funds, as mentioned above.

The need to supplement the City budget allocation for operating purposes has brought home the realization that private funds must be available when necessary requirements cannot be met from public sources. Consequently in an action that marked the resolve of the Board not only to provide this margin of operating support but also to meet a number of capital goals, a fund raising campaign was launched during the year to raise \$1,500,000. Known as the "To Fulfill a Promise" Campaign, an effort, still continuing, was commenced under the leadership of Mr. J. F. Baxter, Chairman, and Mr. Richard A. Kirk and John C. Mitchell, Co-Chairmen. To date approximately ninety per cent of the announced goal has been raised. The response of many segments of the community, individuals, foundations, and corporations, has been very heartening. Support is still most welcome from any who have not yet been contacted.

The purposes of this campaign fall into four major categories: 1) the completion of the York Street Gardens; 2) the development of the participatory gardens in the York-Josephine Street area; 3) Chatfield Arboretum development; and 4) an addition to the Endowment Fund. Completion of the York Street Gardens involves two prominent gardens, the Rock-Alpine Garden and the Japanese Garden. The Rock-Alpine Garden construction has been funded by a \$110,000 grant from the Gates Foundation, and should be under way in the spring of 1978.

The Japanese Garden has been designed by Professor Koichi Kawana, a native of Kyoto, Japan, now on the faculty of the University of California at Los Angeles, but execution of the plan must await funding. Funds to the extent of \$250,000 in the campaign goal have been allocated for this project, and it is hoped that sufficient money will be raised to commence construction in 1978. Some members of the Japanese community are seeking to elicit support from that group, and a number of individuals, including the Ikebana International membership in Denver, are interested in helping to provide an example of this beautiful garden art form for this area.

In addition to a deep well to furnish untreated water for the gardens and the waterways, a particular need in times of water scarcity, which has been funded by a contribution of the Associates of Denver Botanic Gardens, the other major item in the campaign for the York Street Gardens is an orchid and bromeliad display house and special greenhouses for these rapidly growing collections.

The area between York and Josephine Streets, roughly from Tenth to Eleventh Avenue, to the north of the existing parking area, has been designated for participatory gardens for handicapped persons, senior gardeners, and children, all of whom cannot be accommodated at the existing Children's Gardens. This project, estimated at \$250,000, has been partially funded by grants from the Adolph Coors Foundation and the Helen K. and Arthur E. Johnson Foundation. Presently there are several rental properties on this land.

Development of the new Chatfield Arboretum will receive a welcome stimulus if the campaign goals are reached. A Master Plan for this arboretum recently has been accepted by the Board and promises an exciting and interesting additional unit for

Denver Botanic Gardens. This project was discussed at length in the 1976 Annual Report and remains a very important long-range program. An area large enough for extensive tree plantings and testing, it will provide an additional dimension to our service to this entire area. The amount, allocated to Chatfield is \$200,000.

The planned addition of \$500,000 to the Endowment Fund of Denver Botanic Gardens will increase the capacity of the present small fund to produce income to supplement operating funds when needed or to provide a margin of excellence in our maintenance. It is hoped that the existence of this fund, although still quite small, will be emphasized, and interested persons will be reminded to add to it over the years through additional gifts and bequests.

On behalf of the Board of Trustees I wish to here record our continuing gratitude to the Mayor and City Council, to the Manager of Parks and Recreation and his staff, to our own loyal staff, and to the hundreds of volunteers, who all are responsible in one way or another for the progress which we are making. The thousands of hours of volunteer time which have been contributed by the Associates, the Guild, the Around the Seasons Club, and the Garden Club of Denver members are essential to the development of the Gardens and to our overall program.

In the current year, 1978, it is hoped the campaign can be concluded successfully and that a number of the projects it has been designated to fund will be under way.

John C. Mitchell
President

Flower Display — Horticulture Hall



DIRECTOR'S ANNUAL REPORT

1977

Looking ahead to the fulfillment of promises made for the future of Denver Botanic Gardens, during 1977 we of the staff spent much time with the trustees in planning. Along with this, in spite of cuts in employees due to a slashed budget, much has been accomplished in the day to day work of planting, testing, building, and serving the public with beauty to observe, advice on horticultural problems, and educational classes and meetings. The Director is proud to outline in the following pages what has been done during the year 1977 and is grateful to all of those involved — City and County officials, the Department of Parks and Recreation, the Board of Trustees, the membership, the dedicated volunteers, and the staff.

Dr. William G. Gambill, Jr.
Director

Construction and Development of Physical Facilities

During 1977 the irrigation system started in 1976 was extended to include a number of flower beds, the Home Demonstration Garden, the Lilac Garden, the Hildreth Garden mound, and the Juniper Collection. Repairs and adjustments were made to the irrigation system in the Herb Garden as well as in several other parts of the Gardens. This work was done in 1977 as well as in other years by the maintenance workers of the Gardens under the direction of Mr. Jerry Lehr, maintenance repairman.

The pergola around the Herb Garden was completed during the year, and the gazebo at the northeast corner of the Herb Garden will soon be finished.

Harmon, O'Donnell and Henninger Associates, Inc. started a master plan for landscaping and planting at Chatfield Arboretum. The Colorado Forest Service contracted to cut down weeds there and the Army Corps of Engineers paved a walkway in the Arboretum to serve as the basis for a self-guided tour when plantings are done. A grant of \$58,000 from the Colorado State Division of Parks and Outdoor Recreation was made to the Arboretum in 1977.

The very important matter of the development of the water resources at Chatfield is being undertaken by W. W. Wheeler Associates. Already a state permit to drill a replacement domestic water well has been received. Apparently some existing water wells may be re-drilled to develop a larger supply of water. Irrigation water will continue to be a major problem. The drilling of new wells and the utilization of the water from Deer Creek are matters to be settled in the future by adjudication.

Grants from the Colorado State Division of Parks and Outdoor Recreation will be used to start developing the land between York and Josephine Streets and between 10th and 11th Avenues, all of which except for one parcel of land, is now owned by Denver Botanic Gardens. Plans developed in 1977 for this area call for a green oasis, a community garden, a garden area each for senior citizens, the handicapped, young people, and families. A mini-park, with a picnic shelter, a fountain, tables, and a turf area will also be included. Two other areas will be developed — a small solar greenhouse and a parking lot for handicapped. When completed, this area will be a noteworthy extension of Denver Botanic Gardens' services to the Denver community.

The generous bequest of the late Pauline Roberts Steele of 30 acres of land northeast of North Table Mountain near Golden will enable Denver Botanic Gardens to develop another display area of native vegetation.

Plantings and Acquisitions

Spring of 1977 arrived early without extremes in temperatures and no late snows or freezes. The spring bulbs (over 17,100 tulips and 7,200 hyacinths) did very well. The narcissus started in February (along the conservatory) and continued into early April, with beautiful displays of flowers.

This year woody plantings were concentrated on the mound to the south of the greenhouses and in the Lilac Garden. The mound was designed to demonstrate low junipers interspersed with dwarf flowering shrubs and other low evergreens. The juniper collection consists of 34 cultivars. These were planted in groups of three to 25 of each. The low types were planted along the sidewalk, the taller plants higher on the slope, and the upright kinds on the back slope. Blue, green, and mauve types were alternated to give a pleasing aspect in winter as well. The total of junipers planted reached 416.

In addition, a small collection of *Chaenomeles* was interspersed with the junipers. Fourteen cultivars were planted, ranging from five to 16 of each kind. One hundred twenty-four plants were placed. Three cultivars of *Taxus* and three of *Mahonia* were planted on this berm, along with two cultivars of *Viburnum* and two cultivars of *Potentilla*. One of the *Potentillas* is a white-flowering sport of *Potentilla fruticosa* 'Katherine Dykes'.

A dwarf pine (*Pinus densiflora* Sieb. and Zucc. *umbraculifera* Mayr.) and a mock orange (*Philadelphus coronarius* L. *aurea* Rehd.) complete the plantings to date. All of these miscellaneous kinds amounted to 323 plants.

The *Cotoneaster* collection now totals 28 varieties and 136 plants with the addition of two new varieties this year. Another collection installed this year was the *Spirea* group. This consisted of 30 varieties and 110 plants. Both of these collections now enhance the south side of the east-west walk that parallels the Conservatory.

The Lilac Garden is another major space which was planted this year in the southwest portion of the grounds. This area consists of two sloping banks that face each other across a flat center area. A sprinkler system installed in 1977 will provide irrigation to two flower beds, several grass pathways, and a drip system of irrigation for the lilacs. The sod has been installed and steel edging placed alongside it on all the grass pathways. Thirty-four kinds of lilacs have been planted in the center area this year. These are all cultivars of *Syringa vulgaris* L., commonly known as French hybrids. The garden will eventually have 53 kinds, ranging in flower color from white to deep reddish-purple.

An addition to the Rose Garden this year was a small collection of miniature roses, 13 cultivars which totaled 146 plants. In addition eight kinds of miniature tree roses were interspersed among the lower plants.

A total of 140 roses representing 35 varieties was planted in the All-American Rose Selection beds during the year. They will be retained for two years. The Denver Botanic Gardens is one of 26 gardens used for testing the nominees for All-American Rose selection.

Over 20 other species and cultivars were planted in various locations around the Gardens to complete the plantings for 1977.



It's May!

As to herbaceous plantings, over 45,000 plants of annuals (bedding plants) again dominated the scene. The major theme this year was an Indian motif reflected in some of the flower bed designs. The comments were very favorable as to the beauty of these displays.

Forty-five new varieties of annuals were tested this summer. Basic groups included were ageratum, alyssum, aster, begonia, calendula, cosmos, dianthus, geranium, marigold, petunia, portulaca, salvia, snapdragon, verbena, vinca, and zinnia.

Two of the new ageratum varieties are worthy of mention Biscay and Blue Danube (also listed as Blue Puffs). Biscay is a taller variety 8-10" with mounds spreading up to 14" and Blue Danube is a shorter 4" variety with 9" mounds. Both are heavy bloomers. Aster 'Pinocchio' has mixed colors of white, red, light pink, purple, rose, and yellow. It is a late summer bloomer. The compact mounded plants are 10" high and are covered with tiny 1" dahlia type blooms.

The hybrid geraniums (seedling grown) have increased in popularity, and ten new ones were tried in 1977. Geranium 'Sprinter' was outstanding and was used extensively in the flower beds. As they become better known, their popularity should increase even more.

The Dahlia Garden received a major overhaul this year. Many new dahlia tubers were purchased (252) and the Dahlia Society donated others for a total of 359 plants. This made a spectacular display in late summer and early fall.

A cutting garden was attempted this year, primarily for the Around the Seasons group to use at the fall Christmas sale. Late planting caused mixed results. A perennial trial area was planted in September in this location. About 118 perennial species and cultivars were planted.

The *Hemerocallis* garden, with both tetraploid and diploid plants, furnished spots of color over a long blooming period, which extended from the middle of May to fall.

Varieties in the diploid section which attracted attention in 1977 were: Ed Murray — a small flower, very deep red; Irish Conquest — a tall yellow with a green throat; and Jersey Peach. In the tetraploid area of the garden Rocket City, Chicago Full Moon, Mary Todd, and Mountain Violet were notable.

During the year 280 *Iris* varieties were added. Tall bearded species account for about half, the others being divided among miniature and arilbred bearded. This planting completely replaced the original *Iris* Display Garden, consequently the *Iris* display in 1977 was not as showy as it probably will be in 1978.

In the Gladiolus Garden more than 6000 corms were planted during the year. These were in addition to the All-American test garden west of the Conservatory. Red Freckles, Little Sweetheart, El Toro, and Night Owl were All-America choice bulbs of notable beauty. All bulbs planted were a gift of Selected Glads, Inc.

As summer waned, a large bed of flowering kale and flowering cabbage was planted along the sidewalk by the east entrance gate. This planting received the most comment of any of the flower beds. It was quite striking by September and the plants were attractive until November.

Twenty-seven flower beds made the total for this past summer.

The Demonstration Vegetable Garden was planted heavily this year. Most vegetables grew very well; only the corn, potatoes, and tomatoes performed poorly. There were 14 kinds of snap beans, four of beets, ten of cabbage, six of carrots, seven of corn, ten of cucumbers, four of eggplant, seven of lettuce, six of muskmelon, eight of peas, ten of peppers, six of radish, nine of summer squash, four of winter squash, and 22 of tomatoes. Some of these vegetables were grown in hanging baskets or containers. A row of dwarf apple trees was planted along the east side of these gardens and will eventually be espaliered.

The receipt by the Conservatory of the extensive bromeliad collection of the late Walter R. Smith of New Orleans was an event of major significance for the Denver Botanic Gardens. Through the generosity of Mrs. Miriam Smith the conservatory and greenhouses now can show many genera and species of bromeliads not before present in the collection. Mr. William W. Harris presented the Gardens with a nearly complete collection of the bromeliads of Guatemala. The two collections numbered 1325 plants as of December 31.

Significant numbers of orchids from Dr. George Kennedy and from Mr. and Mrs. William Thurston have added 524 plants to the orchid holdings.

Ground covers added in the Conservatory in 1977 made an additional attractive display.

Flower Displays

Flower displays arranged by members of the Conservatory staff were especially outstanding in 1977. Visitors to the Conservatory are always entranced by the flower arrangements in the Lobby Court. These displays form the first impression of the Denver Botanic Gardens for everyone who visits the Conservatory building. For many, who come just for meetings or classes, they are almost the only impression of the Gardens and hence are of great importance in their impact. However, these are only a part of the displays. Attractive flowers are always to be seen in the offices and public rooms in Botanic Gardens House and in the Helen Fowler Library. Special exhibits are always set up for groups which have affairs in Horticulture Hall.

Displays in 1977 in the Lobby Court were ushered in by a fragrant collection of spring bulbs which scented the whole area. Adding visual beauty as well as perfume in the early spring exhibits were tulips, daffodils, hyacinths, scilla, muscari, aconites, and snow drops. Spanish, Dutch, and English iris stood up tall to catch the attention of the viewers' eyes.

Begonias, when on display, featured many tuberous varieties as well as fibrous rooted Reigers from Germany. In shades of pink, red, and yellow they flaunted their beauty in their turn. Lilies on display during the year started before Holy Week when white Easter lilies formed part of an attractive lay out.

Gesneriads, which included African violets, streptocarpus, gloxiniads, sinningas, and columnea were featured later in the year. The new Walter R. Smith collection of bromeliads caused much comment. More than 150 varieties of chrysanthemums ushered in the fall displays. The great range of petal shapes such as spoons, spiders, pom poms, and cascades called attention to the great number of different chrysanthemums available. To these were added the many colors of the very large decoratives. Because the poinsettias were a little late in coming to peak bloom, an unscheduled showing of epiphytic ferns, orchids, and bromeliads was set up in December, but the poinsettias, especially the white ones, made a bright collection to end the year.

Special floral displays in Horticulture Hall were designed and shown for the Ikebana International, the Potters' Guild, the Orchid Society, the Audubon Society, the Colorado Water Color Society, the annual Membership Dinner, and the fund drive report meetings.

Plant Give-Away

Attendance at the Plant Give-Away on May 14 and 15, 1977, more than doubled that of the affair in 1976. Denver Botanic Gardens members carried away 780 free plants during the event.

Lobby Court Display



Plant Sale

Managers of the 1977 Plant Sale, held May 6 and 7, estimated that more than 20,000 people attended. Four abreast, the queue waiting for the 10 a.m. opening on the first day of the sale stretched from the east entrance down York Street and on to Ninth Avenue.

Many people in the metropolitan area wait each year until the Denver Botanic Gardens plant sale gives them an opportunity to buy high quality plants for their gardens. Useful as the sale is to the Associates to raise funds for the activities of the Gardens, the sale is also an opportunity for people to become aware of the many services provided by Denver Botanic Gardens.

Seed Exchange

For the second season the Denver Botanic Gardens distributed its *Index Seminum* to several European countries including the Soviet Union. Approximately 60% of the recipients returned the favor. The Gardens provided three taxa of bulb seeds to the American Horticultural Society for its annual distribution. The exchange of seeds between botanic gardens is an old tradition and is certainly one of their important functions.

Children's, Youths', and Adults' Gardens

The program for children at the Ruth Porter Waring Children's Garden completed its 18th year with a total of 53 children participating. Early in September more than 125 parents and friends saw those children receive diplomas.

Because of the depleted soil — worn by 18 years of heavy gardening — the staff decided to let this area lie fallow in 1978 for at least one growing season except for green manure cover crops.

At the Barrett Elementary School Garden 42 children participated in the program. The teacher was Mrs. Judy DiCroce. The Bell Plumbing and Heating Company made a generous contribution to the Barrett School Garden by moving the meters and controls of the watering system to an area where they can be controlled better.

The Youth Gardens program at Eleventh Avenue and York Street was continued in its second year. Thirty-five adult gardeners cultivated a section of this land which had been set aside for them.

Mr. Lee Schwade and Ms. Beverly Nilsen of the Gardens staff coordinated all of these garden programs. Mr. John Brett acted as instructor. Mrs. William C. Jackson took charge of the Experimental Garden.

Education Program

Even though ten more classes were offered in 1977 in the Education Program of Denver Botanic Gardens than in the previous year they still were over-subscribed with many on waiting lists. The classes covered a wide range of subjects providing some for every interest. Most of them numbered at least 20 students, though a few were limited to 15.

Classes taught were: Landscape Horticulture (Mr. Rollinger and Mr. Watson), Conifer and Flowering Plant Taxonomy (Dr. Denham), Indoor Light Gardening — two classes — (Mr. Davis and Mr. Riley), African Violet Workshop (Hi Hopes Study Club), Carnivorous Plants (Mr. Woodward), World of Palms (Mr. Pierce), Bread Baking — four classes — (Mrs. Price), Basic Mushroom Identification (Mr. Grimes), Dried Flower Arrangements (Mrs. Kosanke), Meet the Grasses (Dr. Zeiner). Field Taxonomy (Dr. Denham), Vegetable Gardening (Mr. Schwade), Fun with Herbs — two classes — (Mrs. Falkenberg), Rose Symposium (Rose Society Members), Tofu, Granola, and Sprouts (Mrs. Price), Starting Plants from Seed (Mr. Schimming), Edible Wild Plants (Miss White), Macrame, Plant Hanger Workshop (Mrs. Kunish), Patio Totems — two classes — (Mr. Latta), Botanical Illustration (Dr. Wingate), Beginning Beekeeping (Mr. Washecka), House Plants as Ground covers (Mr. Pierce), Summer Lawn Care (Mr. Schwade and Mr. Wecal), Rose Beads (Mrs. Clifford), Techniques of Collecting and Drying Flowers in Silica Gel (Mrs. Kosanke), Winter Pruning Tips (Mr. Park), Go Vegetarian, Italian Style (Mrs. Price), Basic Propagation, House Plant Culture, and Plant Groups (Mr. Pierce), Chrysanthemum Culture (Mrs. Collins), Waterwise Gardening (Mr. Rollinger and Mr. Watson).

Instructional Field Trips, in addition to Plant Identification Field Trips conducted by Dr. Brunquist from March through September, included: Tour of Elitch Gardens Greenhouse (Ms. Goeders), Field Trip to Mrs. Shepherd's cabin (Mrs. Shepherd), Tree Walk in Boulder (Mr. Robertson), Field Trip to Mushroom Farm (Mr. Wardle), Conservatory Tour — Plants of the Bible (Mrs. King), Field Trip to Plains Conservation Center (Miss White), Field Trip to Pawnee Grasslands (Mr. Pease), Grass Field Trip (Dr. Zeiner), Field Trip to Colorado Springs (Mr. Long), Field Trip to Mt. Goliath — three classes — (Mrs. Shepherd), Field Trip to Roxborough Park (Dr. Wingate), Field Trip to St. Mary's Glacier (Dr. Gambill), Field Trip to Hoosier Pass (Dr. Denham and Dr. Wingate), Field Trip to Deckers (Mrs. Shepherd and Dr. Wingate).

Mrs. Litschel conducted two classes for children on Pottery and Plants. Tropical Plants of the Conservatory — two classes — were taught for prospective guides by Mrs. Hayward. Guides from these classes led tours for 7,375 people during the year. Eight free films were shown to an average attendance of 22 people.

Student Intern Program

Two high school interns served terms at the gardens, Joan Narverud from Abraham Lincoln High School in Denver from January to May and Kevin Jenkyns from South Denver High School from September to mid-January, 1978. Joan later was hired to work in the Gardens for the summer. From Metropolitan State College came two college interns for the summer months: Joyce Deming and Ron McLellan.

Use of Facilities

Visitors to the Denver Botanic Gardens in 1977, as recorded by the turnstile at the East Entrance, numbered 294,293 — an increase of nearly 20,000 over 1976. Scheduled meetings, lectures, and shows in Horticulture Hall attracted 10,858 persons. Attendance at classes and meetings in the classrooms of the Education Building totaled 10,508. Almost 3500 people came to meetings in Botanic Gardens House.

The annual membership dinner, the Rose Symposium, the Gladiolus and Dahlia Bulb Sale, Historic Denver Garden and Terrace Tour, the membership Plant Give-away, the Colorado Water Color Exhibition, the award party for Dr. Brunquist, and the Children's Garden Graduation Exercises were each attended by several hundred persons.

Estimates based on sales indicated that more than 20,000 visitors crowded the grounds and buildings on May 6 and 7 for the Annual Plant and Book Sale. Thousands were attracted to each of the following: Denver Orchid Society Show, African Violet Show and Sale, Iris Society Show, Colorado Mycological Society Fair, Denver Bonsai Show, 4-H Fair, Gladiolus Society Show, Rocky Mountain Succulent Society Show, Colorado Potters' Guild Show and Sale, Gift Shop Christmas Sale, Audubon Society Exhibition and Sale.



Mycology Society Show

Publications

During 1977, *The Green Thumb*, the quarterly journal of Denver Botanic Gardens, contained articles continuing the series on the history of the site of the Gardens and had more biographies of Colorado botanists. The editorial committee has decided to continue with these two series in 1978.

The Winter Issue, 1977, was given over to articles on drought conditions, gardening and economical use of water under drought conditions, and to a description of two community garden projects carried on in Denver in 1977. The first of these projects was a city-wide one sponsored by the Mayor's Committee and enrolled many hundreds of people. The Children's Gardens on York Street and at Barrett School, and the youth and adult gardens north of the Education building sponsored by the Denver Botanic Gardens were described.

Two long-time members of the Editorial Committee were lost in 1977. The death of Mrs. Pauline Roberts Steele removed a worker whose charming sketches had graced the pages of the magazine for many years. Ms. Suzanne Ash resigned from the Editorial Committee. Her talents as artist and writer will be missed.

The Green Thumb Newsletter appeared monthly under the editorship of Miss Margaret Sikes, Education Director. A regular article on gardening written by Dr. J. R. Feucht accompanied information about the activities of Denver Botanic Gardens in each issue of the newsletter.

Dr. Janet Wingate served as editor of *The Jolly Green Gardener* for the year. This publication was designed for the young people working in the Children's Gardens. Ms. Beverly Nilsen acted as consultant for this project.

Helen Fowler Library

During the year 1977 a micro-film reader and printer was added to the equipment in the Helen Fowler Library. This machine is a real asset to the Denver Botanic Gardens, since it permits the use of much material not before available.

Books added to the collection in the library totaled 746 (including 297 volumes donated) bringing the total collection of books to 7789. More than 5500 books and 451 pamphlets were circulated. Visitors came to the library in the number of 29,403 and 9410 of them used the services and facilities in some way. Staff members of the Denver Botanic Gardens used the library reference material 1311 times.

Without the help of volunteers who put in 4344 hours of work, the services of the library would be severely curtailed. These volunteers and the librarian answered 1751 telephone requests for information.

New memberships in the Denver Botanic Gardens originating in the library numbered 333.

Much of the income for purchase of new books for the library comes from the annual sale of books held each spring in connection with the plant sale. The Associates of the Denver Botanic Gardens, the Applewood Seed Co., the Tremont Foundation, and the Cherry Hills Heights Garden Club all made valuable and appreciated contributions.

Library Lines, a bi-monthly newsletter about the library, made its debut in 1977. The editor is Mr. Ellsworth Mitick, a volunteer.

"Dr. Green"

"My plants froze, will they come back?" "Can I take my plants to California when I re-locate?" "How should my Norfolk Island pine be cared for?" "Is *Rhus trilobata* edible?" "How do you dry cat-tails?" were among the thousands of questions asked of "Dr. Green" in 1977.

Probably as many as 4,500 citizens of Denver called the Denver Botanic Gardens on the telephone or came in person to inquire of "Dr. Green" concerning problems they were having with their gardens or house plants. Ten competent staff members shared in providing this service during two periods each week.

Kathryn Kalmbach Herbarium

The Kathryn Kalmbach Herbarium has been a busy place during 1977. In addition to classifying and filing several small private collections which have been received

as gifts during the year, including one from Mrs. Ruth Ashton Nelson, much time has been spent in serving the public. Many visitors spent time on the balcony where permanent exhibits have included lichens and poisonous plants, as well as specimens of native plants which were on display each week during the season.

During the height of the blooming season as many as 85 native plants were on display at one time, and other weeks there were nearly as many. Visitors use this display for aid in identification of plants on the days in which the herbarium is not open. When the curator and volunteers are there, they spend much time in naming plants and identifying color slide photos for people interested in the Colorado flora. A class in the identification of grasses was taught in the herbarium, and the staff led field trips on grasses and allergy plants.

Students from Metro State College, high schools and junior high schools of the metropolitan area — even from as far away as Boulder — have come to seek information from the specimens and the displays. Student interns have spent time learning while helping in the herbarium during the year.

The herbarium has proved, as in past years, a valuable asset to the public relations of the Gardens.

Mycology Laboratory and Herbarium

Under the direction of Dr. D. H. Mitchel, Honorary Curator, and Shirley W. Chapman, Assistant Curator, the Mycology Laboratory and Herbarium continued its vigorous activities in the area of research, education, and community service.

During 1977 over 1,000 specimens of fungi were collected, described, photographed, studied microscopically, dried, labeled, indexed, and stored for further study. This brings the total number of collections in our herbarium to over 8,000. Specimens were exchanged with other herbaria including the United States Department of Agriculture National Fungus Herbarium in Beltsville, Maryland; the herbaria at the Universities of California, Michigan, North Carolina, and Virginia; and the Canadian Department of Agriculture Herbarium in Ottawa, Canada.

Dr. Mitchel spent the month of August with Dr. Alexander H. Smith in Snowmass at Aspen collecting and identifying fungi and collaborating on two manuscripts now awaiting publication. Shirley Chapman spent a week on the east coast collecting fungi and studying the collections at the USDA Fungus Herbarium with Dr. Farr, the Curator of Myxomycetes. Plans are made and approved, except for funding, to have Dr. Farr review the Colorado Myxomycetes in our herbarium next spring and collaborate on the publication of an annotated list of Colorado Myxomycetes.

One of the most fortunate occurrences than can befall a laboratory that receives no financial support is to receive volunteer help! This happened to us this year in that Vera Evenson, a biologist from Boulder, has worked every Wednesday helping identify and index collections and Kevin Jenkyns, the high school intern for the last quarter of the year, worked with us one-half day a week during November and December filing and labeling slides and assembling over 10,000 boxes to be used for our collections.

Another happy event was the receipt of over 200 labeled specimens with their accompanying color transparencies from Linnea Gillman, a mycologist with the U.S. Forest Service here in Denver.

During the year over 100 identifications of fungi were made for poison centers and the general public. Lectures were given to medical groups and mushroom clubs. Work continued with the Rocky Mountain Poison Center in regularly updating the

mushroom poisoning section of Poisindex. Dr. Mitchel has continued to be active as a trustee of the North American Mycological Association and as a member of the toxicology committee of that organization.

Publications in 1977: Lincoff, Gary and D. H. Mitchel, M.D. *Toxic and Hallucinogenic Mushroom Poisoning: A Handbook for Physicians and Mushroom Hunters*. Van Nostrand - Reinhold, New York. 267 pages, hardcover.

"Statistics — Vital-Yes, Valid-No!" *McIlvainea* 3 (1): 43-48 1977, D. H. Mitchel.

Alaska Trip

July and August 1977 saw 26 Denver Botanic Garden members on a 17 day tour of Alaska under the leadership of the Director, Dr. William G. Gambill, Jr. The party travelled by plane, train, bus, and boat.

Trip members visited the Palmer Experimental Station where Dr. Curtis Dearborn, the Chief Horticulturist, acted as host. The Station is in the Matanuska Valley, the site of an experiment in establishing self-sufficient farms. Especially interesting were the very large vegetables grown on the farms.

Other areas of interest visited were Glacier Bay National Monument, the Kenai peninsula, and Mt. McKinley National Park, as well as a number of Alaskan cities. Everywhere they went members of the party found a profusion of wild flowers, many of them old friends to Colorado botanists. Others were new. Fireweed was abundant, growing nearly everywhere in the 49th state.

At Mount McKinley National Park, Dr. James Mitchell, instructor in botany at the University of Alaska, acted as guide and lecturer for the group. Here there was a chance for much botanizing and an opportunity, apparently rare, to see both peaks of Denali — the Indian name for Mt. McKinley.

Lush climatic conditions were found in the southern tip of Alaska because of the influence of the Japan Current. Here for example delphiniums grew to the eaves of houses.

Special Events 1977

Three unusual and special events occurred at the Denver Botanic Gardens in 1977. The first was a two-day visit by a team of botanists from the Soviet Union, Dr. Valery I. Nekrasov, Chief, Department of Exchange and Seed Investigation, Main Botanical Gardens, Moscow, Dr. Lilian S. Plotnikova, Senior Scientist, Main Botanic Gardens, Moscow, and Dr. Igor V. Belolipov, Senior Scientist, Tashkent Botanical Garden, Uzbek Academy of Sciences. The guests visited several areas in the front range and collected a number of plants. Their visit here was part of a 10 year program of cultural exchange between the U.S.S.R. and the United States, designed for the collection, protection, and introduction of endangered species. Botanists consider this interchange under the direction of the New York Botanical Gardens to be extremely important. Following the return of the visitors to Russia a three man team from the U.S. visited in the Soviet Union for the same purpose.

In June, Dr. E. H. Brunquist, long-time volunteer worker at the Denver Botanic Gardens and leader of many field trips to identify native wild flowers, was given the Minori Yasui award for outstanding community service. Mr. Yasui bestowed the certificate of award to Dr. Brunquist on the grounds of Botanic Gardens House.

December, 1977 was the date for the showing at Denver Botanic Gardens of a large collection of color prints of tropical flowers. This display was lent by the Smithsonian Institution of Washington, D.C. Several hundred people came to the balcony outside the herbarium to admire the really splendid collection of color prints.



Soviet Botanists Visit — Left to right: Dr. Valery I. Nekrasov, Dr. William G. Gambill, Jr., Dr. Lilian S. Plotnikova, Dr. Igor V. Belolipov, Mr. Glenn Park.

Community Service Increasing

One phase of the program of Denver Botanic Gardens which is increasingly fruitful is that of community service. Thousands of people come to marvel at the strange plants in the Conservatory, to admire the beautiful lobby court displays, and to stroll through the grounds enjoying the flowering beauty during the summers, but also thousands come to take advantage of the facilities and services that are not so obvious. An immense amount of free information and entertainment covers a multitude of subjects. These offerings to the public have increased over the years and will continue, it is hoped, to extend the influence of the Gardens into the daily lives of people in the years to come.

Horticulture Hall is the scene of educational meetings, programs, various plant displays, art exhibitions — something different almost daily; many seek identification of and knowledge about native plants in the herbarium; the library is a source of information about anything botanical for members and non-members alike; the mycology herbarium and laboratory furnish information and identification of fungi and work closely with the Rocky Mountain Poison Center in regard to poisonous mushrooms; test plots seek to establish the best turf, roses, and other plants for our queer Colorado climate; "Dr. Green" solves many problems about both garden and house plants and is as near as the phone — all one needs to do is ask; classes taught by experts in a wide variety of subjects are available all year, some for a nominal fee, others free; plots and instruction in gardening furnish direct service to children, youths, and adults in several sections of the city; in these and many other ways the staff and volunteers of the Gardens serve the general public. Plans for the future include a seniors' garden, a garden for the handicapped, family gardens, and a small park where people may find an oasis of shade and rest.

The Education Director devotes most of her time to community service, instruction, and information. Classes cover a wide range of subjects from plant identification, field trips to see the native flora in its own habitats, macrame, pottery making, the lore and use of herbs, and bread baking with many botanical and related topics in between. Many of these classes are open to the public as well as to members and many are free or given for a nominal fee. A number of lectures, slide shows, and movies is given free during the year.

Horticulture Hall Scene of Many Activities

By actual count, over 10,000 people in 1977 attended meetings, lectures, programs, and displays in Horticulture Hall. Here members of the Orchid Society, the Rose Society, the Iris Society, the Bonsai Club, African violet and gladiolus connoisseurs brought choicest blooms and arrangements for display to the public. The Colorado Mycological Society held a fair which attracted over 2000 people interested in identification of and information about mushrooms. Successful finishers in the children's garden program came here for their "graduation" to receive certificates of accomplishment for their summer's work and to display the fruits of their labors. Art exhibits of paintings, photographs, and sculpture are examples of the varied interests that found publicity here in addition to more strictly botanical matters.

The wide range of classes is another facet of the far-reaching public service fostered by the Gardens. Such strictly botanical subjects as landscape horticulture, plant taxonomy, African violet workshop, carnivorous plants, mushroom identification, identification of grasses, vegetable gardening, house plant culture, chrysanthemum culture, botanical illustration, edible wild plants were in 1977 interspersed with beginning beekeeping, macrame, pottery for children, rose beads, breadmaking, vegetarian cooking, dried flower arrangement, fun with herbs, and how to dry plants with silica gel.

Field trips, both near and far, in 1977 as usual each year, were scattered throughout the weeks. They ranged from plant identification trips (March through September) with Dr. Brunquist to visits to Mt. Goliath, Colorado Springs, the Plains Center, Hoosier Pass, and Pawnee Grasslands in search of native plants during the different seasons. These trips were open to all, though sometimes limited in number so that registration was required. Most of them were free.

Through an arrangement with the public schools and with nearby colleges, opportunity has been given to several young people to learn while working through internships, granted for a quarter or a semester. Applicants submit their qualifications and have an oral interview with a committee of three from the Gardens. Several of these students have earned themselves summer jobs at the gardens and a few have developed a life-long vocation. This program, which is part of a national program, is of benefit to the Gardens, but of inestimable benefit to the students taking part. This year of 1977 has been the third year of the program.

The annual plant and book sale, while swelling the coffers of the Associates for donation to the Gardens, attracts thousands from all parts of the region in search of plants that can be depended upon to thrive in the summer gardens. The Plant Sale and Used Book Sale provide more opportunities for more volunteers to share in the program of the Gardens than any other event. The money received on these two days is of great value for the support of the Gardens programs. Judging by the crowds who attend every year, the value of this activity far exceeds in public service the dollars and cents value to the Gardens.

Volunteers, who first attend classes, lead Conservatory tours throughout the year, particularly making the displays meaningful to many groups of school children who would not otherwise appreciate what they see. Guides give many hours to this valuable service.

Some attempt was made in 1977 to relate the study and appreciation of plants to other art forms, such as music, painting, and photography. The collection of flower color prints from the Smithsonian Institution on display on the herbarium balcony

during December and into the new year made a step in this direction. Also an exhibit by the Colorado Water Color Society of Colorado water colors was the center of attraction in Horticulture Hall for two weeks during the summer. Birds held their place in the Audubon Society exhibit of paintings, photographs, and sculpture. For the second year the Colorado Potters' Guild put on a display relating still another art to plants. Plans for the future include other attempts to widen the horizons of plant lovers.

National and international relations received a boost by the seed exchange which has been carried on for the second year. Also, the Gardens staff entertained three visiting botanists from the Soviet Union in August. These things, too, widened the area of community service.

Such are the many instances of service to the community which are sponsored by the Gardens. They reached a new peak in 1977 and plans for the future include increasing numbers.

Mr. Yasui Presents Certificate to Dr. Brunquist.



DENVER BOTANIC GARDENS, INC.

FINANCIAL STATEMENT December 31, 1977

ASSETS

CURRENT ASSETS:

Cash in Checking Accounts	\$ 3,043	
Cash in Saving Accounts	720,141	
Investment Trust Fund	102,732	
Other Current Assets	<u>2,889</u>	
Total Current Assets		\$ 828,805

OTHER ASSETS

Rental Properties	327,990	
Other Real Estate	289,248	
Conservatory	882,894	
Education Building	861,454	
Master Plan Expense	928,284	
Greenhouses	159,001	
Equipment Owned	<u>24,023</u>	
Total Other Assets		<u>3,472,894</u>

TOTAL ASSETS: \$4,301,699

LIABILITIES AND FUND BALANCES

LIABILITIES:

Notes Payable	\$ 170,303	
Rent Deposits	<u>2,698</u>	
Total Liabilities		\$ 173,001

FUND BALANCES:

General	121,858	
Endowment	118,251	
Building & Development	588,696	
Land, Buildings & Equipment	<u>3,299,893</u>	
Total Fund Balances		<u>4,128,698</u>

TOTAL LIABILITIES & FUND BALANCES \$4,301,699

ACCOUNTANT'S OPINION

I have examined the balance sheet of the Denver Botanic Gardens, Inc. as of December 31, 1977. The examination was made in accordance with generally accepted auditing standards and accordingly included such tests of the accounting records and such other auditing procedures as were considered necessary in the circumstances.

In my opinion, the accompanying balance sheet presents fairly the financial position of the Denver Botanic Gardens, Inc. at December 31, 1977.

J. D. Vander Ploeg
Certified Public Accountant

MEMORIAL GIFTS

Memorial contributions have been received during 1977 for the following persons whose names have been inscribed in the Denver Botanic Gardens Book of Memories

Mrs. Ruth D. Armstrong
Mrs. Isabel Burns Barton
Ralph Blanz
Sarah G. Bruce
Arch Brenker
Mrs. Claudia Curfman Castellana
Mrs. Vivian Cole
Catherine Brock Collins
Mrs. Fleeta Cooper
Mrs. Clayton Dorn
Mrs. Edward V. Dunklee
Mrs. Dodie Engels
William J. Geddes
Margaret Glynn
Mrs. Edward Honnen
Marmaduke Holt, Jr.
Dr. C. R. Jacobson
D. P. Krebill
Mrs. Vera Stevenson Lafferty
Judy Littrell
Dr. Maude E. Midgley

Mrs. Louis Morell
Tom Palmer
Stanley P. Petrick
Mrs. Samuel Pyeatt
Mrs. Conrad M. Riley
Mrs. Rhoda Roberts
Ethel E. Robertson
William John Robertson
Mrs. Rae Rogers Smart
Maria Sarazin
Walter R. Smith
August O. Sommerer
Robert M. Stanley
Robert Stanley, Jr.
Steven Stanley
Dr. Robert L. Stearns
Mrs. Pauline Roberts Steele
Mrs. Robert Whealen
Miss Eleanore Mullen Weckbaugh
Miss Doris Wilmore

During the year, the Denver Botanic Gardens received bequests from the estates of Marie Gordon Page, Mary Pauline Roberts Steele, and Eleanore Mullen Weckbaugh (in memory of her mother, Ella Mullen Weckbaugh).

Bromeliad in Lobby Court Display



THE VOLUNTEERS

Their Organizations and Committees

ASSOCIATES OF DENVER BOTANIC GARDENS

Mrs. Herbert Glick	President 1975-77
Mrs. F. V. Altvater	President 1977-79
Mrs. J. C. Dawson	Vice-president
Mr. Charles M. Wilkins	Treasurer
Mrs. William M. Roberts	Treasurer's Assistant
Mrs. Richard M. Millard	Secretary
Mrs. Robert Kosanke	Arts and Crafts Committee Chairman
Mrs. H. E. Secrest	Gift Shop Chairman
Mrs. Ada Gorman	Greenhouse Chairman
Mrs. Martin C. Van de Visse	Guide Committee Chairman
Mrs. Michael S. McLaughlin	Guide Schedule Committee Chairman
Mrs. Alex Scott	Historian
Mrs. William B. Collister	Hospitality Committee Chairman
Mrs. Carl G. Taylor	Library Committee Chairman
Mrs. Charles M. Schloss	Membership Committee Chairman
Mrs. J. V. Petersen	Publicity Chairman
Mrs. Wm. Falion III	Information Desk Chairman

As of October 1977 there were 220 paid-up members in the Associates, most of whom were active, talented, and hard-working Volunteers in many programs.

In addition to their usual volunteer work, the Associates were asked to participate in the drive for the Denver Botanic Fund which they did with great success. Volunteer work, which involved the following areas continued throughout the year: the Gift Shop, the Library, the Hostess and Information Table, the Guide Program in the Conservatory, assistance in the Greenhouses, assistance in the administrative offices when needed, assistance in the Plant Give-Away for members of Denver Botanic Gardens, planners and workers for the three day plant and book sale in May, organizers and workers for the two day Christmas Sale in November, hundreds of volunteer hours spent on Arts and Crafts items which were sold in the Gift Shop and at the Christmas Sale, hundreds of hours spent in helping to entertain special visitors to the Denver Botanic Gardens, hundreds of hours spent in planning, making the decorations, and in decorating the Lobby Court each year, manning special exhibits at the Gardens during all the hours these are open to the public. (The recent exhibit from the Smithsonian Institution is an example.) In fact the Associates are happy and willing to tackle any large or small job requested of them.

Financial commitments to the Denver Botanic Gardens have continued: \$150 monthly to the Library for the purchase of new books and \$6000 annually to the General Fund. At the July 1977 meeting the Associates Board voted to contribute \$50,000 to the Gardens, \$40,000 of which is to be used for a deep well water program and \$10,000 for the Chatfield Fund.

The Associates Board wishes to thank the Trustees for allowing the Associates to be represented on the Board and voted a special thanks to Dr. Gambill and to Margaret Sikes for their constant advice and help.

AROUND THE SEASONS CLUB

Mrs. D. L. Christenson *President, 1976-77*
Mrs. Herbert Franson *President, 1977-78*

The Around the Seasons Club is a horticulture study group whose object is to be service oriented to the Denver Botanic Gardens. The members are always on call whenever a special project comes along which needs helping hands in order to be completed.

The only fund raising project of the year is the annual Dried Material Sale held during the Gift Shop Sale in November. In this project in 1977 the members recorded nearly 100% participation. Members raised plant material, gathered wild plant material, harvested and dried it, priced, packaged, and sold it. Members were also active in other areas of the Christmas Sale as chairmen, sales people, and workshop helpers. Monies from this sale each year are donated back to Denver Botanic Gardens to further designated projects.

In 1977, members made totem planters for the Plant Sale and plan to do so again in 1978. Again, club members participated nearly 100% in the Plant and Book Sale as chairmen and workers in many, many capacities.

During the summer months when regular meetings are not scheduled, field trips are planned. Led by the vast experience of the members who are native plant specialists, members gain enriching insights in whole new areas of nature appreciation.

Around the Seasons Club is a specialty group whose aim is a combination of study and work.

Christmas Sale



THE DENVER BOTANIC GARDENS GUILD

Mrs. Harry Wadsworth	President, 1976-77
Mrs. William L. Cook	President, 1977-78
Mrs. T. W. Wrenn, Jr.	Terrace & Garden Tour Chairman 1977

The activities of Denver Botanic Gardens Guild during 1977 continued to build on the successful projects of preceding years. As before, they participated in the annual May Plant Sale by operating and staffing the herb and vegetable plant booths. This year the sale of herb and vegetable plants exceeded that of any year before.

In 1977 the annual July Terrace and Garden Tour was held in town and as always was quite successful. Profits of \$2,700 were turned over to the Gardens. Members always enjoy putting on the tour and are grateful to the many individuals who graciously allow their lovely gardens to be shown for all to enjoy.

As in the past members continued to work hard to establish and maintain the herb garden — one of their main fields of endeavor. Major construction on the newly expanded Herb Garden is completed. The beautifully done brick walkways, the arbor, the gazebo will add to the enjoyment of a visit to the area. There is now much more room to display a greater variety of plant material.

Tarragon and Herb Vinegars continued to be popular items and sold well at the Christmas Sale. Every year members bottle more vinegar and every year are sold out during the sale. They worked especially hard this year to fill 2,984 bottles of vinegar which was much more than ever before. By noon on Saturday of the Christmas Sale they had sold it all and want to thank everyone who helped make this possible by purchasing the vinegar.

Since the Gardens worked hard to increase its capitalization through the Botanic Gardens Fund Drive this past fall, the Guild, in order to do their part, pledged \$15,000 to be paid over the next three years to the campaign fund, asking that these monies be used to help develop the Alpine Rock Garden.

THE GARDEN CLUB OF DENVER

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Herb Garden Gazebo — Still to be Finished



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1977

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"Dr. Green" at Plant Sale





Orchid in Lobby Court

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East Entrance Gates



INFORMATION FOR CONTRIBUTORS

The Denver Botanic Gardens are supported by funds from the City and County of Denver and by private contributions, memorial gifts, and bequests. The funds from the City and County of Denver are never adequate to pay for acquisition of land, development of new areas, and construction. Only private support can ensure a forward going program designed to meet the promise made when the Gardens were founded.

The Staff and Trustees of the Gardens are grateful for the many memorial gifts which they receive. The bereaved family is always notified of such expressions of sympathy.

These alone are not sufficient to fill the gap between needs and city funds received. We depend upon the generosity of our members and of the public for gifts to make these promises come true.

Unrestricted gifts will be applied where the need is greatest. However, gifts may be designated for such current projects as: Chatfield Arboretum, Orchid-Bromeliad House, Alpine Garden, Japanese Garden, special gardens for senior citizens, the handicapped, and for children.

Please make checks payable to the Denver Botanic Gardens Fund, 909 York Street, Denver, 80206. Gifts are deductible as provided by law. Pledges may be made to extend the payment over three years.

Bequests to the Gardens are exempt from Federal and State inheritance and estate taxes. The following form can be used in making such bequests by will:

I give and bequeath to the Denver Botanic Gardens, a non-profit corporation under the laws of Colorado, the sum of \$ _____ (or describe property).

Date _____, 197 _____

Denver Botanic Gardens To Fulfill a Promise

909 York Street

Denver, Colorado 80206

In consideration of the gifts of others, I/we hereby subscribe the sum of _____ (\$ _____)

To be paid ☐ annually, ☐ semi-annually, ☐ quarterly or
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Total pledge to be paid to the Denver Botanic Gardens over 36 months beginning on or about January 1, 1978.

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Paid Herewith \$ _____ Address _____

Balance \$ _____ City _____

PLEASE MAKE CHECKS PAYABLE TO DENVER BOTANIC FUND

Men at Work



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